McGILL UNIVERSITY MASTER SAMPLES

USER'S MANUAL

Frank Opolko
Joel Wapnick

NOTE

If your compact disc player is misaligned or dirty, you may encounter very unpleasant noises when you attempt to access McGill University Master Samples discs. Such interference might not be noticeable on your other CDs, however. The increase in alignment precision necessary to reproduce our sounds is due to the large number of indexed sounds on each of our discs. Once your machine is correctly aligned and cleaned, you will be able to hear our sounds as they are intended to be heard.

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© Frank Opolko and Joel Wapnick, 1987

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McGILL UNIVERSITY MASTER SAMPLES

COMPACT DISCS, VOLUMES 1-3

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MANUAL: JOEL WAPNICK

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Compact discs were manufactured in the United States.

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FRANK OPOLKO

JOEL WAPNICK

INTRODUCTION

Affordable samplers first became available in 1985. Since that time, they have become very popular. Until recently, however, many owners have been frustrated by the paucity of high quality sounds for their samplers. A number of companies and individuals sell edited sounds for a variety of samplers. However, the quality of their sounds is often poor. Also, sound diskettes are expensive. It currently costs between $10 and $25 to buy diskettes containing samples for only one or two instruments.

Before mid-1986 or so, the task of editing sounds was arduous, even with the help of expensive visual sound editing software. However, most recent samplers have been designed to make sound editing easy, almost automatic. All you need are high quality sounds to input into your sampler.

The McGill University Master Samples library (**MUMS**) provides these sounds. It consists of sounds stored on compact disks. At present, we have produced three volumes, of which you are the owner of at least one. Volume 1 is devoted to strings, Volume 2 to winds and brass, and Volume 3 to piano, percussion, and saxophones. Together, these volumes contain almost all of the sounds found in the contemporary orchestra, plus some additional sounds as well. There are 2,267 sounds on the three volumes combined (847 on Volume 1, 753 on Volume 2, and 667 on Volume 3), and individual sustained sounds last from about 2 to over 10 seconds.

You would have to buy hundreds of diskettes to obtain the sounds stored on one MUMS compact disc--if they were available for purchase!

There are several outstanding features of the MUMS library. First, all sounds were digitally recorded and mastered by an experienced professional

sound recording engineer. Second, most were recorded in a professional sound studio (for certain instruments, however, McGill University's Pollack Hall proved to be more satisfactory). Third, all sounds were performed by concert artists. Fourth, only the very finest instruments were used. Our string volume contains sounds from a Gagliano violin, a Lupot violin, a Gasparo da Salo viola, a Vuillaume cello, and a Mathias Albani double bass, for example. These instruments are collectively appraised at well over $600,000, and they sound it. Fifth, sounds were recorded stereophonically (though they are accessible to monophonic samplers). Sixth, a variety of timbral variations was recorded. For example, all solo strings include pizzicato, bowed sounds with moderate vibrato, bowed muted sounds, sharp attack sounds (martelé), and harmonics. We also have flute flutter-tonguing and muted sounds for many wind and brass instruments, trombone pedal tones, plucked piano strings, and bowed vibes. Seventh, we have included members of instrumental families (four types of flutes, four different clarinets, five different saxophones, for example). Finally, **every note**, with very few exceptions, in the entire range of every instrument was recorded--for timbral variations as well! This last feature was included to satisfy today's sampling enthusiast who has access to high-end samplers and/or to multitracking equipment, and should be very useful for users of the samplers of tomorrow. Such machines will undoubtedly have the memory and flexibility to implement one-sample-per-key sampling.

In short, the MUMS library provides sounds of the highest quality. It is also the most comprehensive such library available anywhere.

Another feature of the MUMS library is the manual you are now reading. It provides ideas on sampling that should help make your edited sounds sound realistic, details teaching and research applications that may

interest you, describes our sounds, instruments, and recording equipment, and includes a directory of sounds, and an index to the directory, with CD referenced location numbers.

Use out product in good health. May it bring you musical fulfillment, intellectual satisfaction, or whatever else you intended it for!

SOME THOUGHTS ON SAMPLING

The sounds on our compact disks were recorded using state-of-the-art digital recording equipment. They were recorded by a professional sound recording engineer and played by professional musicians. The very finest instruments obtainable were used. The sounds on these CD's make it possible for you to create extremely high-quality sampling diskettes. However, having access to great sounds does not guarantee that you will make great samples. In addition to a decent sampler, you also need a little knowledge concerning the sampling process.

The purpose of this section is not to rehash instructions on how to operate various brands of samplers, but to provide you with some useful techniques for producing realistic sounds. If you are experienced at sampling, you probably know about most or all of these techniques. If you haven't yet done any sampling, or if your samples sound like various organ stops, read on.

INPUTTING SOUNDS FROM YOUR COMPACT DISC PLAYER TO YOUR SAMPLER

ADJUST THE LOUDNESS OF THE SOUND TO BE INPUTTED SO THAT IT IS AS LOUD AS POSSIBLE, BUT WITHOUT DISTORTION RESULTING. Use the clipping indicator on your sampler to make certain that your sound is recorded without distortion. Once you have determined the loudness level at which distortion becomes barely noticeable, reduce the

loudness very slightly to eliminate the distortion. This process will maximize the signal-to-noise ratio of your samples, thereby making them sound as clear and crisp as possible.

CAPTURE ALL OF THE SOUND'S ATTACK. One of the most common errors in sampling is to cut out part of a sound's attack. The attack of almost any instrument by itself sounds awful. However, attacks are crucial for instrument identification. An attack that is weak or missing usually results in a sample that sounds more like an organ stop than the instrument it was supposed to be. One way of avoiding this problem is to sample a small portion of the silence preceding every note. The silence can easily be edited out later, without eliminating even the slightest portion of the sound's attack.

PLANNING THE SOUNDS TO GO ON YOUR DISKETTE

THE MEMORY LIMITATIONS OF YOUR SAMPLER WILL FORCE YOU TO COMPROMISE. ALLOCATE MEMORY WISELY TO CREATE SOUNDS THAT SUIT YOUR PURPOSE. Perhaps there will soon be affordable samplers that will provide so much memory and so many mapping locations that compromises between sample rate, sampling length, and number of notes sampled per instrument will no longer be a concern. Imagine, for example, a sampler with 16-bit resolution that would allow the user to load into it five-second stereo samples, sampled at 40 kHz, for each of the 88 notes of a piano. The resulting sound would be exceedingly realistic, and the five-second duration would be long enough to eliminate the need for looping the sounds. However, our hypothetical sampler would require over 35 megabytes of memory! Compromise is thus clearly called for.

Let us now see how sampling rate, sample duration, and number of notes sampled per instrument affect sound quality.

SAMPLING RATE. The sampling rate is the number of times per second that the voltage of the sound is measured by a sampler. Most samplers allow you to sample at a number of different rates. Companies thus often advertise the amounts of sampling time available to the user in terms of these different rates: "50 seconds of sampling time at a sampling rate of 8 kHz, 12.5 seconds of sampling time at a rate of 32kHz, or 8.3 seconds of sampling time at 48 kHz", for example (a kHz, or kilohertz, is equal to 1000 Hertz; a Hz is one cycle per second). These statistics tell you the total amount of time available to you if you were to sample all of your sounds at one sampling rate. Given the above hypothetical specifications, for example, you could create eight one-second samples if you sample at 48 kHz. If you sample at 8kHz, you could create 25 different two-second samples, or 50 different one-second samples--if your sampler is capable of mapping to 50 different locations (at present, most aren't).

The higher the frequency of the sampling rate that you use, the better the quality of the resulting samples. The generally recommended formula for the rate you should use is that it should be about twice as great as the highest frequency component of the note to be sampled. This is the so-called Nyquist frequency.

Overtones from many instruments, even including those with low-pitched ranges, are audible at or close to the ear's upper limit for pitch perception. We once tried to conserve sampler memory by sampling very low notes on the piano at a rate of 16 kHz rather than the 42 kHz rate we used for higher-pitched notes. Unfortunately for us, well over 40 overtones on low piano notes are audible. The 16 kHz rate was sufficient for reproducing

the fundamental and lower overtones of the sound, but it was insufficient for accurately reproducing the higher overtones. This resulted in a noticeably darker and more lifeless sound for the bottom of the piano than for the rest of its range.

The upper frequency threshold for hearing is about 20,000 Hz for children, and is slightly lower for adults. According to Nyquist's principle, a sampling rate of about 40,000 Hz will therefore enable you to reproduce any sound realistically. Lower rates might be suitable for speech and low-pitched instruments that are not harmonically complex, and for applications that do not require high fidelity sound.

SAMPLE DURATION. The longer a sample's duration, the greater the amount of precious memory that it eats up. It is for this reason that it is necessary to limit each sample's duration.

You are probably aware that most samplers have editing capabilities for combatting their memory limitations. The basic process consists of making a "loop" in the sound, so that part of the sound is repeated over and over. A looped sound may be sustained indefinitely, without using up additional memory. Short percussive sounds die out quickly and do not have to be looped. However, sustained sounds often require looping.

There should not be a discernable difference in sound quality before and after the loop point. In order to accomplish this, the loop must be placed somewhere in the steady state portion of a sound, as steady state waveforms, unlike the waveforms characteristic of most instruments' attacks and decays, are stable and regular. The theoretical minimum duration of a sound (that is intended to sound realistic) preceding the loop point is thus the length of the sound's attack time plus one cycle. This is a very brief duration. Alas,

theory and reality conflict: for most instruments, a considerably longer duration is required for creating good loops.

The actual minimum requisite duration of a sample depends on the duration of the sound's attack and on the regularity of the sound's steady state. Sounds that have rapid attacks and very regular steady state waveforms (such as barred percussion instruments) can be looped after about half a second from onset. Most brass, stringed, and wind instruments require a somewhat longer duration, as their attack times are longer and their steady state waveforms are less regular. Finally, there is the piano! The piano's "steady state" is by nature unsteady. However, it generally becomes more stable the longer it continues. It is usually impossible to create seamless loops on piano samples that are less than a second in duration. There is often a noticeable change in quality at the loop point for such samples, with the looped sound having either a rougher or a more nasal quality than the natural sound. The change in quality at the loop point also explains why rapidly played piano music on a sampler may sound extremely realistic, but piano music played more slowly may sound unsatisfactory.

These problems are much less serious for longer samples. The increased regularity of the piano waveform over time accounts for the improvement by making the creation of seamless loops easier than for briefer sounds.

NUMBER OF NOTES SAMPLED PER INSTRUMENT. Use an adequate number of sounds to realistically reflect the characteristics of the instrument you are sampling. With the exception of some unpitched percussion instruments, one sampled sound doth not an instrument make. The timbral characteristics of an instrument change dramatically along its frequency range. Low pitched sounds generally contain a greater number of

audible harmonics than do high pitched notes, for example. As a result, one sound will suffice for only a fraction of an instrument's full range. It is necessary to use many sampled sounds to represent most instruments realistically, and the technical term for this practice is multisampling.

The amount of multisampling that is necessary to create a good instrumental sound varies from instrument to instrument. In general, however, we have found that samples don't sound very good when played back at a distance of more than a minor third above or below the original sampled sound. Instruments whose waveforms are complex (such as the piano and violin) require a narrower range. Instruments whose waveforms are relatively simple, however, require less multisampling.

The amount of multisampling needed to adequately recreate an instrumental sound also determines the number of different instruments that will fit on one sampling diskette. It is difficult to create a realistic violin-piano diskette, for example--the memory and mapping requirements of most samplers do not currently allow for it. However, a diskette consisting of different instruments that differ somewhat in pitch range is possible. In such a case, only portions of an instrument's range may be sampled to conserve memory. The diagram below portrays the layout of a hypothetical cello-viola-violin diskette, given 16 mapping locations. One

SAMPLE NUMBER	NOTE	INSTRUMENT	SAMPLE RANGE
1	D2	CELLO	C2 TO E2
2	F#2	CELLO	F2 TO G2
3	A2	CELLO	G#2 TO B2
4	C#3	CELLO	C3 TO D3
5	E3	CELLO	D#3 TO F3
6	G#3	VIOLA	F#3 TO A3
7	B3	VIOLA	A#3 TO C#4
8	D#4	VIOLA	D4 TO E4
9	F#4	VIOLA	F4 TO G4
10	A#4	VIOLA	G#4 TO B4
11	C#5	VIOLIN	C5 TO D#5
12	F5	VIOLIN	E5 TO F#5
13	G#5	VIOLIN	G5 TO A#5
14	C6	VIOLIN	B5 TO D6
15	E6	VIOLIN	D#6 TO F#6
16	A6	VIOLIN	G6 TO C7

limitation of this diskette is that each pitch is represented by one and only one instrument. Middle C (C4) is a viola sound, for example. The same strategy might be used for a flute-piccolo diskette, a saxophone quartet diskette, a clarinet family diskette, and so forth.

Create instrument combination diskettes that match your personal needs. Perhaps you want a contrabass clarinet/bowed vibraphone combination. It is possible to make such a diskette using McGill Sound Resources CDs! Less exotic combinations that you might consider are woodwind quartet, violin and one or two instruments (other than piano), flute and oboe, non-pitched percussion and wind instruments, and brass choir. Remember, however, that you must work within the restrictions of your sampler.

COMPROMISE. Decisions regarding sampling rate, sample duration, and extent of multisampling on a sampling diskette are best arrived at

through experimentation. Make several different diskettes of the sounds you want. On one, you might use a lower sampling rate to allow for more multisampling and longer samples. On another, try a high sampling rate with perhaps short samples and less extensive multisampling. On a third, try multisampling to the extent that your sampler allows by shortening the sample durations or lowering the sampling rate. Then listen and compare.

You might also conserve memory by limiting the range of your samples. If you do not need extremely low and high piano sounds, for example, don't create samples for them. Lavish your sampler's resources on only the notes that you do need. You might be wise to create very high quality samples for the most often heard portions of your instrument's range, even if it requires skimping a little on the other pitches. Your multisampling on the violin might be more intensive in its low and middle registers than for its highest pitches, for example.

CHOOSE TONALLY CONSISTENT SOUNDS TO SAMPLE. When we listen to music, we are rarely aware of the considerable qualitative differences that exist between different sounds from the same instrument. Some sounds are weaker than others. Others may differ in fullness, brightness, or resonance. These differences become much more apparent when the sounds are sampled. A sampled sound that is slightly more brilliant than others from the same instrument will be perceived as markedly different, as that sound will be reproduced for a range of notes rather than for one note only. Many samplers allow for the layering of two samples with cross fading of their amplitudes to combat this problem. This process essentially combines the characteristics of adjacently pitched samples so that the timbral characteristics of the sounds between the samples change gradually. In this fashion, qualitative differences between samples become

less noticeable. However, cross fading is expensive in that it eats up another voice during the cross fading period. It can be avoided by either initially choosing sounds so that they "match" well, or by using the sampler to modify samples' sounds.

All sounds on MUMS CDs were recorded at least twice. We emphasized to our artists the importance of attaining timbral evenness from note to note. We then painstakingly chose the sounds that seemed to be the cleanest and most consistent of those recorded. Nevertheless, perfect timbral consistency within instruments is impossible to achieve--it simply is not in the nature of musical instruments to be so consistent. Moreover, sonic differences as a function of different registers (as for example on the clarinet) or of open versus closed strings creates additional inconsistencies between sounds.

Listen to our sounds before you decide which ones to sample. If you were planning to use middle C for your sample, for example, but that sound happened to be a little too dark in comparison with your other sounds for that instrument, consider using the adjacent B or C# instead.

UNIQUE INSTRUMENTAL CHARACTERISTICS SHOULD BE TAKEN INTO ACCOUNT WHEN ASSIGNING SAMPLES TO PITCH RANGES. Some wind instruments such as the flute, clarinet, and bassoon have two or more registers. As each register of such an instrument has tonal characteristics that are distinct from the instrument's other registers, it is important to avoid the assigning one sample to a pitch range that would overlap two registers. A clarinet chalumeau sample, for example, should not be used to produce sounds that properly belong to the throat register.

MODIFYING THE SOUNDS ON YOUR SAMPLING DISKETTE

Through the use of analog controls on your sampler and peripheral devices such as graphic equalizers and digital reverberation and effects units, it is possible to modify you samples in a variety of ways. Some of the modifications are: high frequencies can be filtered out; the resonance of a sound can be increased or decreased; the brightness of a sample can vary systematically with how loudly it is played; and a sample's attack, sustained portion, and decay can be independently manipulated. Graphic equalizers can be used to brighten or darken a sample. Digital reverb and effects units can be used to imitate ambiences of differently sized rooms and halls, or to transform sounds in a number of unusual ways.

If you are intent on producing samples that are as realistic as possible, then do as little modification to your samples as possible. You might occasionally find it necessary to brighten or darken a sound so that it better matches your other sounds. You might also want to fiddle around with your final decay rates from time to time (we once reduced the dryness of our piano samples by slowing down their final decay rates, for example). In addition, careful editing of amplitude envelopes may sometimes be necessary to accurately mimic the envelope of an acoustic instrument. More extensive modifications should rarely be necessary. Moreover, they invariably result in unrealistic samples.

Much has been made of the fact that an instrument's timbral spectrum depends on the loudness with which the instrument is played. Specifically, upper overtones gain in strength relative to lower overtones as an instrument is played louder and louder. Some experts believe that it is therefore

necessary to sample the same sound at different loudness levels in order to attain true realism.

The noticeability of timbral changes that are concomitant with changes in loudness is a matter of some controversy. Some musicians claim that such changes are obvious. On the other hand, it is possible that they are mislabelling loudness change as timbral change. There is in fact some research showing that sounds from the same note performed at greatly varying loudness levels and subsequently played back at the same loudness level cannot be distinguished from each other by professional musicians. Some informal tests that we have done suggest that struck or plucked sounds (e.g., pizzicato strings, piano, xylophone) are noticeably brighter when played loudly than when played softly, and that the effect of loudness on brightness is much less pronounced for bowed or blown instruments. Consequently, if you have a sampler that enables you to make sounds brighter as you play louder, use this feature with care if your goal is to create realistic sounds.

STEREO SAMPLING

All instruments were recorded stereophonically. In addition, unpitched percussion instruments and ensemble violin were recorded dry and ambient. You may sample these notes monophonically from either the left or right channels, or from both channels combined. Or you may choose to make stereo samples.

Stereo sampling is possible on any sampler that has two outputs. Its main drawback is that it eats up twice as much memory as monophonic

sampling, given the same numbers of notes sampled. Its main advantage is that it produces stereophonic music. Once you hear the result, you may never be satisfied with monophonic samples again. Affordable samplers have in fact recently been introduced that have built-in stereo sampling capabilities. With such machines, stereo samples from the MUMS library are as easy to make as monophonic samples are for monophonic machines.

It is beyond the scope of this manual to describe the process of making stereo samples when using a monophonic sampler. An excellent article by Tom Calderaro and Paul Wiffin on this topic can be found in the April, 1987 issue of Keyboard magazine. Stereo samples are easy to produce using MUMS CDs, however. There should be no difficulties related to phase differences from the two channels, as the onset of both sounds is preceded by the same silence.

ULTRAREALISTIC SAMPLING

The McGill Sound Resources Library is designed for samplers of the future as well as those of the present. You can make very fine sampling diskettes by inputting our sounds into most of the currently available consumer-oriented samplers. However, you would not need all of the sounds we have provided for each instrument, as the memory limitations of your sampler would not allow you to use them all.

What would your diskette sound like if you were able to store every note of an instrument on it? We have not yet heard such a beast, but we imagine that the result would be incredibly realistic and satisfying.

In the not-to-distant future, reasonably priced samplers will have the capacity to provide one-to-one sound-note sampling. In the meantime, there are at least two ways of achieving this. You don't have to own a Fairlight or a Synclavier, but you must have access to additional equipment such as a multitrack recording system with a SMPTE or FSK timing device (for temporally coordinating material on different tracks), or multiple consumer-oriented samplers. Also necessary would be a computer with MIDI interface and sequencing software to store your music. Sequencers can be thought of as computer-based sound recorders. They can record and play back whatever you play on a MIDI keyboard with great fidelity. The good ones have many other features. For our purposes, the most important of these are the ability to record on many different tracks, to send music on each track to a different MIDI channel, and to assign music to tracks on the basis of pitch range.

A first step in the production of one-to-one sound-note sampling is the actual creation of sampling diskettes to represent the instrument you want to reproduce. You might construct a six-diskette piano, for example, with each diskette containing 14 or15 samples. Next, play your music and store it via the sequencer. Then the fun begins.

Let us suppose that you are indeed fortunate enough to have access to a 24-track recorder. Align your tape to its starting point, and prepare the recorder so that it will record on Track 1. Now insert your first diskette into the sampler and record your work. If your first diskette includes the lowest 15 notes of the piano, that is all you will hear and that is all that will be recorded. Next, rewind the tape and align it to the beginning of your recording with the SMPTE device. Set the recorder to record on Track 2.

Insert your next diskette into the sampler and record your music over again. Repeat this process until you have recorded all six diskettes.

With a 24-track recorder, you need not limit yourself to six diskettes. You could, for example, create 23 diskettes: let us say 12 for one set of soft piano stereo samples (each containing 7 or 8 different notes), and 11 for loud piano stereo samples (one of the 24 tracks cannot be used for recording, as it must be reserved for SMPTE time code). With a little planning and a decent sequencer, you could assign the sounds to be played by each sample to its own individual track. A similar strategy might be used for recording string music so that any of the variety of qualities that we have provided for you (e.g., bowed, bowed with mute, pizzicato, martelé, and harmonics) could be integrated into a single musical composition. You might even create an orchestra in this way. The prospect of editing dozens or hundreds of samples is daunting, but the musical rewards are likely to be well worth the effort. Besides, the editing of samples these days is much less arduous than it used to be.

If you had a number of samplers hooked up to your computer and sequencer, you could attain one-to-one sound-note sampling in a more straightforward way. With a six-diskette piano and six samplers, for example, simply insert a different diskette into each sampler. Direct the sequencer to organize its six tracks by pitch range so that the material on each track corresponds to one and only one diskette. Then assign each track to the MIDI channel that is connected to the appropriate sampler. The advantage of this process is that the entire composition can be heard immediately rather than after multitracking has been completed. This makes editing of the music much easier. The disadvantage is that it is multiple samplers do not often hang out in the same place. It may be difficult to connect them up, they take

up space, and they are of course expensive. A possible solution is to use a four-track tape recorder in conjunction with multiple samplers. Material from all six samplers could then be recorded on each of the four tracks without resorting to bouncing down tracks, which would harm the quality of the sound.

TEACHING AND RESEARCH APPLICATIONS

The uses of McGill University Master Samples for teaching and research are perhaps less obvious than their compositional, performance, and sound recording applications. Nevertheless, we believe that such uses are very important. Indeed, one of our primary reasons for creating MUMS was to provide tools so that certain music skills might be taught more effectively than before, and that research questions concerning music could be solved more easily than was previously possible.

TEACHING

ENHANCEMENT OF EDUCATIONAL MUSIC SOFTWARE. It is likely that the way music will be taught in the future will be very different from how it has been taught in the past. The change will primarily be due to technological developments. So far, these developments have centred on the computer. Hundreds of applications have already been developed for music education. They deal with a wide variety of topics including notation fundamentals, instrumental fingerings, ear training, intonation training, history, and theory.

These programs vary in quality. Some are primitive and untested. Others are much more sophisticated and have even been subjected to controlled experimentation for evaluation. Unfortunately, however, many of these programs are used with computer bleeps and blips rather than more traditionally "musical" sounds. Some programs have no MIDI implementations. Others have MIDI capabilities, but are not used with MIDI

devices because of the additional expense involved in purchasing a synthesizer or sampler. Finally, MIDI-generated sounds often lack realism. Despite the increased sophistication of synthesizers, it is still very difficult to create accurate imitations of most standard musical instruments. Samplers have made this task much easier. However, good samples are hard to come by. Commercially available diskettes are often lacking in quality. The problem with making one's own samples lies primarily in the recording process: few people have access to both the very finest recording equipment and the players and instruments needed to perform the sounds.

This is where MUMS comes in. By creating your own sampling diskettes from our sounds, your MIDI-based music software programs can drive a tremendous variety of extremely realistic sounds. In addition to enhancing existing software, perhaps software developers will be encouraged to develop more context-based software. For example, an interval recognition program requiring intervals to be identified in musical excerpts rather than in isolation might come very close to training a skill that is actually required of musicians, *if* the musical excerpts really sound like music.

THE CLASSROOM SETTING. Easy access to a wide variety of traditional sounds can be very useful for a classroom teacher. Our CDs could be used to create instrumental sounds for ear training classes, for example. In the vast majority of such classes, students are trained exclusively on the piano. This no longer needs to be the case. Students can be trained on any instrument the teacher wishes to use. String quartets, brass choirs, and wind ensembles might be used for four-part dictations, for example. The excerpts might be recorded prior to class (if there is a tape recorder in the classroom

for playback), or the sampler might actually be brought to class and played by the teacher. It is possible that some ear training skills learned at one instrument may not transfer well to other instruments. This potential problem would be eliminated by using many different sounds for ear training.

In addition to ear training, other aspects of teaching might also benefit from our CDs. Music history teachers might create their own excerpts for the classroom or for a paper presentation. Despite the large number of currently available classical recordings, there is still an immense literature of unrecorded works. If a teacher wishes to present some of these to students or colleagues, (s)he can now do so without performing the music or hiring other musicians to perform it. The teaching of composition might be assisted by having students prepare their works in sound as well as on paper. A teacher's suggested revisions concerning some aspects of a work could be made at the lesson and heard immediately.

TIMBRAL RECOGNITION. Perhaps the most obvious teaching application of MUMS is in training students to be sensitive to tonal differences. It is our experience that many first year undergraduate music majors are unable to correctly identify, or even distinguish between, some of the standard orchestral instruments. Their ears may not be sufficiently trained, or they may be unfamiliar with the instruments.

A teacher might use MUMS to create recorded transcriptions for training timbre recognition. The same musical excerpt might be prepared using a variety of woodwind instruments, for example. Another approach is to train students individually at the sampler. If students had access to a sequencer as well as the sampler, they could create their own musical

excerpts and then hear them played back on a variety of different instruments. They might even learn about timbre by listening carefully to the sounds on our CDs *before* they are inputted into a sampler. Granted, it is not very exciting to listen to isolated sounds, but for this purpose it may be educational.

Our samples are especially suited for increasing sensitivity to the more subtle aspects of timbre. Some discriminations that might be taught include: natural versus artificial string harmonics, muted versus unmuted instrumental sounds, qualities of different registrations within one instrument, and differences between types of the same instrument (E flat clarinet versus B flat clarinet, for example).

RESEARCH[1]

As is the case for music teaching, technological change will likely revolutionize the ways in which music researchers conduct their work. Although a considerable amount of knowledge has been acquired as a result of experimental research, certain musical phenomena have remained difficult to examine. The primary reason for the difficulty has been the incompatibility of two needs: the need for strict experimental control and the need to design studies that reflect musical reality.

The need for strict experimental control has and always will be necessary for determining the true significance of an experiment. This need has sometimes forced researchers to use sounds in their studies that musicians

[1] A portion of this section was derived from an article by Joel Wapnick titled"Computers with samplers: some applications for music discrimination and preference research" (Journal of Research in Music Education, in press).

rarely encounter (sine, square, and sawtooth waves, for example). In addition, experimental tasks often have not resembled musical tasks. It is one thing to determine the flatness or sharpness of a bleep in relation to a previously heard bleep. It may be quite another to detect flatness and sharpness in music.

The remainder of this chapter discusses how new technology can be used to increase our knowledge about certain aspects of music. This new technology consists of the combined use of sampler and sequencer.

A sequencer can be either a software program or a dedicated piece of hardware. In either case, good sequencers give the user almost complete control over a piece of music. Tempos, dynamics, note durations, and pitches (usually of sounds from MIDI-driven synthesizers and samplers) can be established with very fine resolution. They can also be varied independently of each other. Sequencers thus provide researchers with their absolute necessity: control.

Samplers provide the potential for approximating musical reality to a greater degree than was previously possible. Why use rarely encountered sounds when access to a sampler, compact disc player, and MUMS string, wind, brass, percussion, and piano sounds can be used instead?

MUSIC PERCEPTION

Tempo. The technology described above can be used to create musical excerpts that differ from each other only on certain musically important temporal dimensions. For example, sequencers make it possible to study the discrimination of overall tempo variability within musical excerpts

(rhythmic steadiness), note-to-note or part-by-part fluctuations (rubato), and gradual changes (accelerando and ritardando).

Pitch. Not all sequencers and samplers provide easy control over pitch variation. Those that do, however, can be used to study the perception of flatness and sharpness in ways not previously attempted. The discrimination of microtonal variations can be examined using the sounds of acoustic instruments and within musical contexts. The ability of listeners to reliably hear performers' intentional shadings in intonation could be ascertained, for example. Stimulus materials could be created to investigate why *a cappella* choirs sometimes drift into flatness (the MUMS library will eventually include solo and choral voices), or whether excerpts performed in different temperament systems (e.g., Pythagorean, mean-tone, just, equal) can be distinguished from each other when they are each programmed to include enough random error so as to approximate human performance.

Tone quality. Research dealing with tone quality has in part been limited to the perception of individual tones devoid of musical context. These studies have yielded interesting results, particularly in regard to instrument identification. It is unclear how applicable these studies are to actual musical listening, however.

The main advantage of using the sampler for research in tone quality is that it makes possible the systematic study of tone quality variations within musical excerpts. For example, a set of MUMS piano samples can be modified to make a number of similar sets of samples--bright piano, dark piano, piano with weakened or strengthened attacks, and so forth. These different versions can then be heard in performances of the same sequenced musical excerpts. Such an approach may lead to interesting findings

concerning the discrimination of tone quality and the identification of instruments in performance.

Touch. Touch can be thought of as the ratio of note durations to the silences between them. Musical qualities such as staccato, portamento, and legato are clearly related to this ratio.

Most sequencers are able to modify the touch of a musical excerpt easily. Touch discrimination ability could thus be determined by a procedure such as the following: subjects listen to two versions of the same excerpt, differing only in touch. Their task is to indicate whether the touch used in the second version is more staccato-like, more legato-like, or the same as the touch used in the first version. Knowledge as basic as the number of different discriminable touches possible on given instruments could thus be acquired. Subjects' labeling of touch terms might also be studied as a function of musical style or instrumentation.

MUSICAL PREFERENCES

The combined use of sampler and sequencer appears to be especially useful for the study of musical preferences. In addition to the more detailed investigation of factors already studied, this technology can assess preferences for factors that are musically important but have not yet been researched. These factors are related to performance practice and interpretation.

Tempo. Sequencers can be used to create excerpts for studying tempo preference as a function of many factors. It could be determined, for example, if interpretations that emphasize inner voicings are preferred at slower tempos than interpretations that do not emphasize inner voicings.

Tempo preferences could also be studied as a function of ornamentation, instrumentation, and pitch level of excerpts. Results from one such study recently conducted at McGill indicate that instrumentation indeed affects tempo preference.

Sequencers and samplers can also be used to study preferences for aspects of tempo variability such as rubato, accelerando, and ritardando. For example, relative preferences for two versions of a Chopin Nocturne, differing from each other only in the amount of rubato employed, could be determined.

Pitch. The sampler/sequencer combination can be used to study the function of microtonal variation in enhancing musical performance. Violinists' enharmonically equivalent note pairs are presumably played at slightly different frequencies. These intonational shadings may be important for enriching the expressivity of the performance. If they are, it is reasonable to assume that listener preference for performances with such intonational shadings would be greater than preference for performances without such shadings. This assumes that the programming of specific microtonal variations is done in a musically intelligent manner.

Perhaps the most direct way of examining the effects of microtonal variations on preference is to transform a fixed-pitch instrument so that it is a variable-pitch instrument. By using a sequencer and sampler, it is possible to obtain preferences for piano music played on fixed- and variable-pitch pianos. Without this equipment, the methodology for conducting such research would have been unthinkable.

Tone quality. Most sequencer/sampler research applications in the area of tone quality preference will require researchers to make their own samples. This would be necessary in order to compare preferences for

different instrument brands, for instrumental variants as a function of musical style (e.g., preferences for the pianoforte versus the fortepiano in the music of Mozart), or for performing style (e.g., brilliant versus restrained sound production) as a function of musical style, for example. Although the MUMS library is not suited for these applications, it might be used to determine preferences for different instrumentations of musical excerpts. Such preferences could be established by presenting different instrumentations of musical examples, through the use of different combinations of samples, to subjects. This approach might also be used to establish preferred instrumentations as a function of tempo, pitch level, texture, dynamic level, and style. Results could be of considerable interest to composers and arrangers.

Other aspects of performance. Some additional factors that might be investigated in terms of their effects on listener preference are ornamentation, phrasing, types of errors made (some seem very disruptive, others hardly noticeable), and accentuation. It should also be possible to operationalize a concept such as "formal unity" and to assess preference for different "amounts" of it. For example, a fugue that is performed so that subject entries are phrased consistently might be compared with a performance in which subject entries are phrased with more variety.

Current technology can be used to make a perfectly controlled performance of even the most complex music. It is therefore conceivable that a musician who is not an accomplished technician on a musical instrument could create recorded performances that might be rated by knowledgeable listeners as highly as, or possible more highly than, performances by established concert artists. On the other hand, it may be that what separates these artists from the rest of us are their imaginative

powers. Research on this topic may have profound consequences concerning how musical performing ability is assessed.

MUSIC EDUCATION

In addition to determining the effectiveness of the teaching applications described earlier in this chapter, the MUMS library could be used to examine how instrumentations may affect musical learning. Results from a recent study conducted at McGill indicate that music majors' accuracy in transcribing two-part dictations is affected by both the instruments they play and by the instruments performing the dictation exercises: pianists were more accurate on piano exercises than on non-piano exercises, and string players were more accurate on string exercises than on non-string exercises. There are many other musical skills that may be similarly affected by instrumentation: remembering and identifying previously heard music, determining the form of a piece while listening to it, identifying harmonic changes, error detection ability, and so on. Results from studies in this area might have direct implications for the teaching of music. For example, it might be argued from results of the dictation study cited above that a variety of instruments should be used to train skill in taking dictation, and that beginning students should initially be trained on their major instruments.

COMPOSITION

There are precious few studies of any kind dealing with the act of composition. If one were to in fact rate the importance of composition from an examination of both the educational curricula in our schools and the activities of our researchers, one might conclude that composition is among

the more trivial activities a musician might engage in--certainly less important than recreating music someone else has written, reciting facts about music, or sightsinging a melody.

Anyone who has ever tried it knows how difficult composition can be. Conjuring up and ordering original and worthwhile musical ideas is only part of the difficulty. Composers almost never get to hear what they are writing when they are writing it (imagine the plight of a performer who is prevented from clearly hearing every note of what (s)he is playing!). In addition, composers often must translate their creations into musical notation. This process can be both time consuming and frustrating.

Sequencers and samplers change this situation dramatically. Composers with no performance skills can hear what they have just created (though a rudimentary ability at the keyboard will hasten the process considerably). They can even hear the intended instrumentations of their pieces, if samples for the required instruments are available. In addition, they need not notate their creations in order to save them. If a notated version of a work is desired, however, the notation could be accomplished by a sequencer.

Research can determine whether this technology will actually improve compositional quality, increase productivity, or enhance enjoyment of the composing experience. As we know so little about something so important, such research would seem to be especially welcome.

SOUNDS AND INSTRUMENTS

Within the time limitations of three compact discs, we have attempted to provide you with as comprehensive and useful a collection of instrumental sounds as possible. Unfortunately, it was not possible to give you everything we wanted to. We would have liked to include viola, cello, and double bass ensembles on Volume 1. It also would have been nice to include saxophones on Volume 2 instead of Volume 3, and to have included sets of pedalled piano samples on Volume 3.

It was our intention to provide every pitch within the entire range of each instrument, and for all variations of each instrument as well. We almost succeeded! The only instruments for which we intentionally did not include every pitch are the saxophones, the alto trombone, and ensemble violin. In order to fit the saxophones on Volume 3, we eliminated some of the notes from each of the five instruments that overlap the ranges of other members of the saxophone family. Similarly, we have eliminated the alto trombone's lower pitches, which overlap with the tenor trombone (every pitch of which is on Volume 2). We thus have included every pitch within the ranges of the saxophone and trombone families, but not every pitch for each instrument within these families. Time restrictions also forced us to limit our violin ensemble samples somewhat. Every pitch in the range was recorded for bowed notes, but a few pitches are missing in the pizzicato and martelé variations. Artificial harmonics and muted strings were not recorded.

We sincerely apologize for three pitches that were accidentally excluded from the MUMS library. They are A#3 in the martelé variation for viola, A#4 in the Bach trumpet, and E2 in the tuba.

STEREO AND CHANNEL SEPARATION

All of our sounds have been recorded in stereo. This enables you to create stereo samples, or to combine left and right channels for monophonic samples. For violin ensemble and unpitched percussion samples, the two channels differ in terms of microphone placement and ambience. Left channel sounds are close and dry, whereas right channel sounds are slightly digitally delayed with a small amount of digital reverberation added. The strengths of the two channels can be mixed to create the quality of sound you most desire.

VOLUME 1: STRINGED INSTRUMENTS

Solo violin, viola, cello, and double bass: Sound variations recorded on these instruments were bowed, bowed with mute, pizzicato, natural harmonics, artificial harmonics (except double bass--such notes are impossible for one person to play on this instrument), and martelé (martellato--a sharp, quick downbow). For bowed sounds without mute, we recorded two different samples for those pitches playable on both an open string and on a closed string. This was not always done for the other variations, however.

Our first intention was to record bowed string sounds without vibrato. This is the generally recommended way to do it, as it allows the user to add one's own desired amount of vibrato by adjusting the vibrato modulation wheel on the sampler. Also, sustained sounds with vibrato sound terrible when transposed, as the rate of vibrato varies directly with the pitch distance from the originally sampled note.

We found, however, that string samples without vibrato were most unsatisfactory. No amount of MIDI controlled vibrato could compensate for the artificiality and shallowness of the sound. We then sampled the violin with vibrato, and obtained much finer results. We had a sound that actually sounded like a real violin! It is for this reason that we have included sustained string sounds with a moderate amount of vibrato rather than with no vibrato at all.

Ensemble violin : Sound variations recorded for ensemble violin were bowed, pizzicato, natural harmonics, and martelé.

The ensemble violin sound was created by multitracking, overdubbing, and subtle digital processing in which five **different** recordings of each pitch were combined. As noted above, the left channel was recorded close and dry whereas the right channel was recorded with greater ambience.

THE INSTRUMENTS: The violin used for recording the solo string sounds was made by Ferdinando Gagliano, and dates from 1780. Though Gagliano instruments are perhaps less renowned than those of some other makers, they are nevertheless exceedingly fine instruments. They are modelled on Stradivari's violins.

A Lupot violin was the source of the string ensemble sounds. Nicolas Lupot (1758-1824) is sometimes referred to as the "French Stradivari." He is considered to be the greatest French violin maker. In a **New Grove Dictionary of Musical Instruments** article, Charles Beare refers to Lupot's "incomparable good taste in workmanship", and to the "aristocratic tonal qualities" of his violins.

The viola recorded on Volume 1 is an authentic Gasparo da Salo. Gasparo (1540-1609) was the first, and perhaps finest, maker of violas.

Beare comments that "his violas are regarded by many players as tonally better than any other. They have a full and reedy quality, combined with a stronger response than many Cremonese instruments." Gasparo's viola's are also exceedingly rare: only 17 authenticated such instruments now exist.

The cello recorded on Volume 1 was made by Jean-Baptiste Vuillaume (1798-1875). It dates from 1860. Vuillaume was a famous maker and dealer of stringed instruments. He produced thousands of violins, but was especially renowned for his cellos, of which only two or three dozen survive. Most of his cellos were copies of a Stradivari instrument.

The double bass recorded was a Mathias Albani, with c extension. It was made in the early 1700's, in Cremona. The bow was made by Emil Sartory (French, early twentieth century).

VOLUME 2: WOODWIND AND BRASS INSTRUMENTS

The following instruments were recorded as they are typically played, and without any additional timbral variations such as flutter-tonguing or muted: alto flute, oboe, English horn, clarinets, bassoons, alto and bass trombones, and tuba.

Flutes: In addition to the c flute and piccolo, the alto and bass flutes were recorded as well. The piccolo, c flute, and bass flute were recorded both with and without flutter-tonguing.

Clarinets: Volume 2 contains sounds from a standard B flat clarinet, an E flat clarinet, a bass clarinet, and a contrabass clarinet.

Bassoons: Both a standard bassoon and a contrabassoon were recorded.

French horn: The French horn was recorded both muted and unmuted.

Trumpets: In addition to the standard B flat trumpet, the Bach trumpet was also recorded. The B flat trumpet was performed both with and without mute. A Harmon mute was used, with stem out. This produced a classic Miles Davis sound, which can be brightened to create a more traditional muted trumpet sound.

Trombones: The sounds from three different trombones (alto, tenor, and bass) were recorded. The tenor trombone was additionally recorded with mute.

THE INSTRUMENTS: The flute in c was made by Haynes in 1923. It is a Sterling silver flute, and has a slightly more mellow sound than the silver flutes made since 1950 or so. The piccolo is made of silver, and was also made by Haynes. The bass flute was made by Ruddal, Carte Ltd., and the alto flute was made in East Germany by Mönnig.

The oboe recorded on Volume 2 was a Laubin, made in 1984. The English horn was made by Lorée, in 1976.

The b flat clarinet was made by Selmer (model 10-G). It was played with a Vandoren B-45 hard rubber mouthpiece. The bass clarinet was a Ruddal, Carte Ltd. instrument, also played with a Vandoren B-45 hard rubber mouthpiece. The e flat clarinet was made by Buffet, and a Vandoren B44 mouthpiece was used to play it. The contrabass clarinet (in e flat) was a Selmer, played with a Selmer D mouthpiece.

The bassoon and contrabassoons were both made by Heckel. The bassoon dates from 1930, and its model number is 6186. The contrabassoon was made in 1951, and its model number is 670.

The French horn heard on Volume 2 was a Conn 8D Lawson Leadpipe. A Giardinelli C8 mouthpiece was used.

The alto, tenor, and bass trombones were made by Yamaha, Conn (model 88H), and Bach (model 50B2), respectively. Bach mouthpieces were used to play all three instruments. Model numbers were 5GS for the alto trombone, 5G for the tenor trombone, and 1.5G for the bass trombone.

The tuba was made by Rudolf Meinl (5/4 c.c.), and an L-S "Pro" mouthpiece was used.

VOLUME 3: GRAND PIANO, PERCUSSION, AND SAXOPHONES

Grand pianos were recorded soft, loud, and with plucked strings (right pedal depressed). The strings were plucked with two fingers, except for the top eight notes for which this was impossible. Strings for these notes were plucked with the aid of a dime.

Both the marimba and the xylophone were played with a hard mallet. The vibraphone was recorded both with a hard mallet and bowed. The glockenspiel and crotales were played with brass beaters.

Unless otherwise indicated in the directory, the remaining skin, wood, and metal percussion instruments were recorded with the ambience and reverberation characteristics of a moderately sized room (about 20' by 20'). The many variations recorded for these instruments can be easily found in the Volume 3 directory, tracks 11 and 12.

Five different saxophones were recorded: bass, baritone, tenor, alto, and soprano.

THE INSTRUMENTS: Two different Steinway pianos were recorded on Volume 3. One was a Hamburg Steinway, Model D (a nine-foot

instrument). The sounds from this instrument are very bright, and seem especially suitable for rock and other types of extroverted popular music. The other instrument was another Model D (much mellower), and was used for the soft and plucked strings recordings. Both instruments were recorded in McGill's Pollack Concert Hall.

The marimba was a grand symphonic marimba, made by Musser. It was made of Kelon, which is a form of pressed fibreglass. A medium-hard Stevens mallet was used to play it.

The xylophone was also made by Musser, and of Kelon. Hard acrylic mallets were used.

The vibraphone was made by Musser (model M55). It was played with hard mallets. A double bass bow was used for the bowed variation.

The glockenspiel was made by Ross, and the crotales were made by Zildjian. Brass beaters were used to play both instruments.

The tubular bells were made by Musser (model 665). They were played with a rawhide hammer.

The 14" by 12" snare drum was a Pearl ("free floating system"). The marching snare (also 14" by 12") was made by Premier. The rock snare was 14" by 6.5" in size, and was a TAMA product. Ludwig was the manufacturer of the military snare (15" by 10").

Trak was the maunfacturer of the 8" and 10" tom-toms recorded on Volume 3. The following drums were produced by LP: small and large timbales, bongos, conga, and tumba. The conga and tumba were made of fibreglass.

The orchestral bass drum, rock bass drum, and tympani are Ludwig products.

The 20" Chinese cymbals was manufactured by Paiste (model 505). The 15" Turkish cymbals are medium thin, and they were made by Sabian (HH). The orchestral cymbals are Viennese style, and were also made by Sabian (HH).

The three gongs were made by Paiste, and the brake drum came from an old car (you don't really have to know the model!).

The ice bells are a UFIP product. The mark-tree was made by OM Percussion, Ludwig manufactured the two triangles and the ratchet, and the temple blocks were made by Yamaha.

The following small percussion instruments were made by LP: woodblocks, claves, cabasa, and cuicas.

The tambourine is a Grover product, and the waterphone was made by Richard Water.

These instruments were hand made: alpenglocken, cencerros (Greece), agogo bells (Africa), finger cymbals (Tibet), sleigh bells (France), bamboo chimes, castanets (Spain), maracas (Brazil), whip, log drums, and Chinese ascending gongs (China).

The soprano, alto, and baritone saxophones recorded on Volume 3 were all Selmer Mark VI instruments. The tenor saxophone was a Selmer Super Action '80. The bass saxophone was made by Holton and Co., is silver plated, and is in b flat. Selmer S-80 mouthpieces were used with all instruments except the bass saxophone (size D for the soprano saxophone, size E for the other saxophones). No name could be found on the bass saxophone mouthpiece.

THE RECORDING EQUIPMENT

Utmost care was taken during the recording process to ensure that the special timbral personalities of each of the instruments would be maintained. While consistent sound levels within instrumental groups was considered an important feature, it became apparent that the character of each instrument should present itself naturally and without the aid of levelling processors (ie. compressors or limiters) which would have altered the transient portion. Some notes may thus appear louder (or even brighter) than others in keeping with the instruments own resonance patterns. This kind of timbral diversity within each register should add realism to musical arrangements.

A musical instrument radiates its sound in complex patterns. Generally, the lower pitched instruments (double bass, bass saxophone, contrabassoon, etc.) will emit sounds omni-dirctionally while the higher sounding instruments (piccolo, flute, oboe, Bach trumpet, etc.) radiate more directionally. Stereo microphone arrangements augmented by the occasional microphone in close proximity to the instrument was considered adequate in relaying this information. By offering stereo separation without compromising mono compatibility, the McGill University Master Samples library can be used with any present or future sampler.

MUMS were digitally recorded using the Sony PCM 3202 DASH recorder (A/D rate- 44.1 KHz. with no emphasis). High quality B & K omni-directional condenser microphones (model 4003) interfaced with a B & K microphone pre-amp. In addition , Sennheiser MKH40 condensers (cardioid) were employed in spaced and near-coincident stereo arrangements. These microphones were then routed through a Sony/MCI

MXP3630 automated mixing desk. Some instruments were then minimally equalized (the console contains a 4 band Wien type equalizer).

In the case of the violin ensemble (on Vol.1) and various percussion instruments (on Vol.3), multi-tracking was employed. In these cases, sounds were overdubbed and subsequently mixed so that the left channel remained dry while the right channel either emulated the ambient characteristic of a large concert hall (violin ensemble) or of a smaller room (percussion). This approach allows the user to balance or mix these channels in order to provide the desired depth perspective for each instrument.

Our overriding objective was to maintain the sonic fidelity of the instruments we recorded. Very little outboard processing was therefore employed. Occasional use of noise gates (Kepex 2) along with Telcom noise reduction were employed during multi-tracking in order to preserve overall fidelity, however.

DIRECTORY OF SOUNDS

The sound directory that follows gives the location, description, and duration of each sound on Volumes 1-3 of the MUMS library, regardless of the volumes you have purchased. If you have all three volumes, great. If not, we hope you will drool over the contents of the volume(s) you don't have and then order it (them).

Sounds on MUMS CDs are all tuned to A440, and are referenced at concert pitch. C4 = middle C (262 Hz). Durations given are accurate to the nearest frame, or about .03 of a second.

VOLUME 1: SOLO STRINGS AND ENSEMBLE VIOLIN

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
01-01	Violin, bowed	G3	5.83
01-02	"	G#3	5.20
01-03	"	A3	5.80
01-04	"	A#3	5.40
01-05	"	B3	5.70
01-06	"	C4	4.80
01-07	"	C#4	5.40
01-08	"	D4, closed	5.40
01-09	"	D4, open	5.37
01-10	"	D#4	6.50
01-11	"	E4	5.87
01-12	"	F4	5.73
01-13	"	F#4	5.20
01-14	"	G4	6.53
01-15	"	G#4	5.63
01-16	"	A4, closed	5.50
01-17	"	A4, open	7.43
01-18	"	A#4	6.80
01-19	"	B4	4.70

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
01-20	Violin, bowed	C5	5.10
01-21	"	C#5	4.53
01-22	"	D5	4.57
01-23	"	D#5	4.47
01-24	"	E5, closed	5.70
01-25	"	E5, open	4.83
01-26	"	F5	4.50
01-27	"	F#5	5.17
01-28	"	G5	5.10
01-29	"	G#5	5.00
01-30	"	A5	4.87
01-31	"	A#5	5.43
01-32	"	B5	5.43
01-33	"	C6	5.03
01-34	"	C#6	5.03
01-35	"	D6	5.63
01-36	"	D#6	6.20
01-37	"	E6	4.90
01-38	"	F6	4.57
01-39	"	F#6	5.87
01-40	"	G6	4.80
01-41	"	G#6	5.43
01-42	"	A6	5.53
01-43	"	A#6	4.90
01-44	"	B6	5.27
01-45	"	C7	3.37
02-01	Violin, muted	G3	3.37
02-02	"	G#3	3.50
02-03	"	A3	6.13
02-04	"	A#3	5.43
02-05	"	B3	4.87
02-06	"	C4	5.17
02-07	"	C#4	5.33
02-08	"	D4, closed	5.87
02-09	"	D4, open	6.13
02-10	"	D#4	5.93
02-11	"	E4	5.57
02-12	"	F4	5.70
02-13	"	F#4	5.53
02-14	"	G4	5.17

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
02-15	Violin, muted	G#4	4.90
02-16	"	A4, closed	4.97
02-17	"	A4, open	6.47
02-18	"	A#4	5.33
02-19	"	B4	4.90
02-20	"	C5	4.97
02-21	"	C#5	4.97
02-22	"	D5	5.57
02-23	"	D#5	4.77
02-24	"	E5, closed	5.00
02-25	"	E5, open	5.07
02-26	"	F5	5.00
02-27	"	F#5	4.67
02-28	"	G5	6.23
02-29	"	G#5	5.20
02-30	"	A5	4.97
02-31	"	A#5	5.17
02-32	"	B5	5.57
02-33	"	C6	5.57
02-34	"	C#6	3.97
02-35	"	D6	4.73
02-36	"	D#6	4.70
02-37	"	E6	4.37
02-38	"	F6	5.80
02-39	"	F#6	5.00
02-40	"	G6	4.73
02-41	"	G#6	5.93
02-42	"	A6	5.17
02-43	"	A#6	4.90
02-44	"	B6	4.90
02-45	"	C7	3.27
03-01	Violin, pizzicato	G3	0.83
03-02	"	G#3	0.67
03-03	"	A3	0.50
03-04	"	A#3	2.87
03-05	"	B3	3.27
03-06	"	C4	2.70
03-07	"	C#4	2.93
03-08	"	D4, closed	3.67
03-09	"	D4, open	2.57

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
03-10	Violin, pizzicato	D#4	1.73
03-11	"	E4	2.07
03-12	"	F4	1.47
03-13	"	F#4	2.90
03-14	"	G4	1.50
03-15	"	G#4	1.40
03-16	"	A4, closed	1.97
03-17	"	A4, open	2.17
03-18	"	A#4	1.83
03-19	"	B4	1.43
03-20	"	C5	1.40
03-21	"	C#5	0.47
03-22	"	D5	1.63
03-23	"	D#5	1.33
03-24	"	E5, closed	1.03
03-25	"	E5, open	1.47
03-26	"	F5	1.97
03-27	"	F#5	1.67
03-28	"	G5	1.83
03-29	"	G#5	1.60
03-30	"	A5	2.20
03-31	"	A#5	2.27
03-32	"	B5	2.20
03-33	"	C6	2.13
03-34	"	C#6	1.90
03-35	"	D6	1.17
03-36	"	D#6	2.47
03-37	"	E6	1.70
03-38	"	F6	1.20
03-39	"	F#6	1.77
03-40	"	G6	0.40
04-01	Violin, natural harmonics	G4	3.20
04-02	"	D5	2.23
04-03	"	B5	3.97
04-04	"	D5	3.93
04-05	"	A5	3.47
04-06	"	F#6	2.50
04-07	"	A5	2.87
04-08	"	E6	3.87
04-09	"	C#7	3.13

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
04-10	Violin, natural harmonics	E6	2.53
04-11	"	B6	4.40
04-12	"	G#7	4.20
04-13	"	G#6	4.10
04-14	"	A6	4.47
04-15	"	A#6	3.03
04-16	"	B6	4.43
04-17	"	C7	4.17
04-18	"	C#7	3.90
04-19	"	D7	4.63
04-20	"	D#7	3.80
04-21	"	E7	3.03
04-22	"	F7	4.70
04-23	"	F#7	3.60
04-24	"	G7	4.37
04-25	"	G#7	3.07
05-01	Violin, martelé	G3	2.70
05-02	"	G#3	1.43
05-03	"	A3	1.77
05-04	"	A#3	2.43
05-05	"	B3	1.63
05-06	"	C4	1.83
05-07	"	C#4	1.80
05-08	"	D4, closed	1.77
05-09	"	D4, open	1.90
05-10	"	D#4	3.17
05-11	"	E4	1.60
05-12	"	F4	1.57
05-13	"	F#4	0.57
05-14	"	G4	1.10
05-15	"	G#4	1.73
05-16	"	A4, closed	1.33
05-17	"	A4, open	1.47
05-18	"	A#4	1.00
05-19	"	B4	0.90

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
05-20	Violin, martelé	C5	1.70
05-21	"	C#5	0.90
05-22	"	D5	1.10
05-23	"	D#5	0.43
05-24	"	E5, closed	1.07
05-25	"	E5, open	1.77
05-26	"	F5	1.00
05-27	"	F#5	1.23
05-28	"	G5	0.80
05-29	"	G#5	1.00
05-30	"	A5	0.90
05-31	"	A#5	0.73
05-32	"	B5	1.07
05-33	"	C6	0.57
05-34	"	C#6	0.40
05-35	"	D6	0.70
05-36	"	D#6	1.57
05-37	"	E6	0.67
06-01	Viola, bowed	C3	4.67
06-02	"	C#3	3.83
06-03	"	D3	4.20
06-04	"	D#3	4.80
06-05	"	E3	4.50
06-06	"	F3	3.77
06-07	"	F#3	3.73
06-08	"	G3, closed	4.73
06-09	"	G3, open	4.50
06-10"	"	G#3 G#3	4.03 4.03
06-11	"	A3	4.27
06-12	"	A#3	4.60
06-13	"	B3	3.07
06-14	"	C4	4.30
06-15	"	C#4	3.77
06-16	"	D4, closed	3.53
06-17	"	D4, open	5.10
06-18	"	D#4	3.67
06-19	"	E4	3.23
06-20	"	F4	3.67
06-21	"	F#4	3.30
06-22	"	G4	5.20
06-23	"	G#4	4.93

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
06-24	Viola, bowed	A4, closed	4.37
06-25	"	A4, open	4.60
06-26	"	A#4	5.13
06-27	"	B4	5.40
06-28	"	C5	5.80
06-29	"	C#5	5.07
06-30	"	D5	5.53
06-31	"	D#5	1.93
06-32	"	E5	4.60
06-33	"	F5	5.33
06-34	"	F#5	6.67
06-35	"	G5	4.20
06-36	"	G#5	5.83
06-37	"	A5	5.27
06-38	"	A#5	4.23
06-39	"	B5	2.90
06-40	"	C6	5.00
06-41	"	C#6	5.53
06-42	"	D6	4.70
07-01	Viola, muted	C3	5.93
07-02	"	C#3	4.33
07-03	"	D3	4.97
07-04	"	D#3	3.23
07-05	"	E3	4.33
07-06	"	F3	4.97
07-07	"	F#3	2.13
07-08	"	G3, open	1.70
07-09	"	G#3	3.53
07-10	"	A3	2.13
07-11	"	A#3	2.90
07-12	"	B3	3.33
07-13	"	C4	4.00
07-14	"	C#4	3.40
07-15	"	D4, open	3.13
07-16	"	D#4	4.30
07-17	"	E4	2.70
07-18	"	F4	3.20
07-19	"	F#4	2.70
07-20	"	G4	4.07
07-21	"	G#4	3.33
07-22	"	A4, open	3.67

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
07-23	Viola, muted	A#4	2.33
07-24	"	B4	2.57
07-25	"	C5	2.90
07-26	"	C#5	2.93
07-27	"	D5	3.07
07-28	"	D#5	3.37
07-29	"	E5	2.33
07-30	"	F5	2.47
07-31	"	F#5	3.20
07-32	"	G5	1.67
07-33	"	G#5	2.27
07-34	"	A5	3.03
07-35	"	A#5	1.87
07-36	"	B5	2.67
07-37	"	C6	2.40
07-38	"	C#6	2.43
07-39	"	D6	1.33
08-01	Viola, pizzicato	C3	4.30
08-02	"	C#3	1.73
08-03	"	D3	2.83
08-04	"	D#3	2.03
08-05	"	E3	2.40
08-06	"	F3	1.70
08-07	"	F#3	1.67
08-08	"	G3, open	4.20
08-09	"	G#3	3.30
08-10	"	A3	3.50
08-11	"	A#3	2.57
08-12	"	B3	1.67
08-13	"	C4	1.67
08-14	"	C#4	2.13
08-15	"	D4, open	6.43
08-16	"	D#4	2.40
08-17	"	E4	2.37
08-18	"	F4	3.43
08-19	"	F#4	2.20
08-20	"	G4	3.60
08-21	"	G#4	2.40
08-22	"	A4, open	4.77
08-23	"	A#4	2.97
08-24	"	B4	3.20

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
08-25	Viola, pizzicato	C5	4.03
08-26	"	C#5	2.37
08-27	"	D5	3.13
08-28	"	D#5	3.87
08-29	"	E5	2.43
08-30	"	F5	1.20
08-31	"	F#5	3.33
08-32	"	G5	3.87
08-33	"	G#5	2.33
08-34	"	A5	1.47
09-01	Viola, natural harmonics	C4	2.93
09-02	"	G4	5.23
09-03	"	C5	4.07
09-04	"	G4	3.90
09-05	"	D5	4.90
09-06	"	G5	4.23
09-07	"	D5	4.43
09-08	"	A5	3.77
09-09	"	D6	4.37
09-10	"	A5	4.63
09-11	"	E6	2.73
09-12	"	A6	3.87
09-13	Viola, artificial harmonics	C5	3.77
09-14	"	C#5	3.80
09-15	"	D5	2.60
09-16	"	D#5	3.70
09-17	"	E5	2.20
09-18	"	F5	2.73
09-19	"	F#5	2.07
09-20	"	G5	2.87
09-21	"	G#5	1.90
09-22	"	A5	2.77
09-23	"	A#5	2.60
09-24	"	B5	2.30
09-25	"	C6	1.33
10-01	Viola, martelé	C3	3.10
10-02	"	C#3	2.83
10-03	"	D3	2.83
10-04	"	D#3	3.30
10-05	"	E3	3.13

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
10-06	Viola, martelé	F3	2.27
10-07	"	F#3	2.43
10-08	"	G3, open	3.40
10-09	"	G3, closed	1.93
10-10	"	G#3	3.77
10-11	"	A3	2.20
10-12	"	B3	2.47
10-13	"	C4	2.63
10-14	"	C#4	1.73
10-15	"	D4, open	2.90
10-16	"	D#4	2.40
10-17	"	E4	2.87
10-18	"	F4	1.97
10-19	"	F#4	1.57
10-20	"	G4	3.27
10-21	"	G#4	3.00
10-22	"	A4, closed	2.23
10-23	"	A4, open	3.40
10-24	"	A#4	2.50
10-25	"	B4	1.93
10-26	"	C5	2.77
10-27	"	C#5	2.23
10-28	"	D5	3.47
10-29	"	D#5	1.63
10-30	"	E5	1.63
10-31	"	F5	3.10
10-32	"	F#5	2.47
10-33	"	G5	2.07
10-34	"	G#5	2.40
10-35	"	A5	1.67
10-36	"	A#5	1.33
10-37	"	B5	1.63
10-38	"	C6	1.03
11-01	Cello, bowed	C2	6.47
11-02	"	C#2	6.50
11-03	"	D2	7.27
11-04	"	D#2	6.67
11-05	"	E2	3.00
11-06	"	F2	3.00
11-07	"	F#2	3.40
11-08	"	G2, closed	5.00

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
11-09	Cello, bowed	G2, open	6.63
11-10	"	G#2	4.00
11-11	"	A2	4.77
11-12	"	A#2	3.67
11-13	"	B2	4.73
11-14	"	C3	3.90
11-15	"	C#3	3.90
11-16	"	D3, closed	4.30
11-17	"	D3, open	4.90
11-18	"	D#3	4.00
11-19	"	E3	4.53
11-20	"	F3	3.97
11-21	"	F#3	4.10
11-22	"	G3	4.40
11-23	"	G#3	4.57
11-24	"	A3, closed	4.53
11-25	"	A3, open	5.43
11-26	"	A#3	4.20
11-27	"	B3	4.70
11-28	"	C4	3.40
11-29	"	C#4	4.43
11-30	"	D4	4.73
11-31	"	D#4	3.73
11-32	"	E4	3.67
11-33	"	F4	2.53
11-34	"	F#4	3.17
11-35	"	G4	3.53
11-36	"	G#4	3.07
11-37	"	A4	3.90
11-38	"	A#4	3.07
11-39	"	B4	3.67
11-40	"	C5	2.50
11-41	"	C#5	3.30
11-42	"	D5	3.83
11-43	"	D#5	2.40
11-44	"	E5	1.80
11-45	"	F5	2.00
11-46	"	F#5	1.77
11-47	"	G5	2.33
12-01	Cello, muted	C2	4.77
12-02	"	C#2	3.90

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
12-03	Cello, muted	D2	6.77
12-04	"	D#2	4.37
12-05	"	E2	4.37
12-06	"	F2	4.10
12-07	"	F#2	4.00
12-08	"	G2, open	5.40
12-09	"	G#2	6.93
12-10	"	A2	7.80
12-11	"	A#2	5.63
12-12	"	B2	4.33
12-13	"	C3	4.50
12-14	"	C#3	4.47
12-15	"	D3, open	6.53
12-16	"	D#3	3.50
12-17	"	E3	3.90
12-18	"	F3	3.23
12-19	"	F#3	3.33
12-20	"	G3	4.53
12-21	"	G#3	3.57
12-22	"	A3, open	7.03
12-23	"	A#3	5.03
12-24	"	B3	4.17
12-25	"	C4	5.17
12-26	"	C#4	4.03
12-27	"	D4	4.63
12-28	"	D#4	3.93
12-29	"	E4	3.70
12-30	"	F4	2.87
12-31	"	F#4	3.70
12-32	"	G4	3.37
12-33	"	G#4	3.30
12-34	"	A4	4.63
13-01	Cello, pizzicato	C2	6.17
13-02	"	C#2	4.33
13-03	"	D2	5.27
13-04	"	D#2	4.07
13-05	"	E2	4.40
13-06	"	F2	5.87
13-07	"	F#2	4.23
13-08	"	G2, open	5.83
13-09	"	G#2	3.80

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
13-10	Cello, pizzicato	A2	5.47
13-11	"	A#2	5.03
13-12	"	B2	5.60
13-13	"	C3	7.00
13-14	"	C#3	6.10
13-15	"	D3, open	7.60
13-16	"	D#3	5.80
13-17	"	E3	6.37
13-18	"	F3	4.80
13-19	"	F#3	6.17
13-20	"	G3	7.03
13-21	"	G#3	5.20
13-22	"	A3, open	5.20
13-23	"	A#3	6.10
13-24	"	B3	5.00
13-25	"	C5	5.60
13-26	"	C#5	4.20
13-27	"	D5	5.77
13-28	"	D#5	5.83
13-29	"	E5	5.07
13-30	"	F5	4.93
13-31	"	F#5	5.90
13-32	"	G5	4.23
13-33	"	G#5	5.67
13-34	"	A5	5.13
13-35	"	A#5	3.87
13-36	"	B5	3.80
13-37	"	C5	3.20
13-38	"	C#5	2.83
13-39	"	D5	1.63
14-01	Cello, natural harmonics	C3	8.37
14-02	"	G3	7.97
14-03	"	E4	6.43
14-04	"	G3	7.77
14-05	"	D4	8.73
14-06	"	B4	6.67
14-07	"	D4	7.20
14-08	"	A4	5.20
14-09	"	F#5	5.67
14-10	"	A4	4.00
14-11	"	E5	6.57

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
14-12	Cello, natural harmonics	C#6	6.90
14-13	"	C5	7.63
14-14	"	C#5	7.10
14-15	"	D5	6.60
14-16	"	D#5	5.00
14-17	"	E5	5.90
14-18	"	F5	5.73
14-19	"	F#5	5.30
14-20	"	G5	5.33
14-21	"	G#5	4.90
14-22	"	A5	6.23
14-23	"	A#5	6.70
14-24	"	B5	6.17
14-25	"	C6	5.20
15-01	Cello, martelé	C2	0.77
15-02	"	C#2	0.93
15-03	"	D2	0.70
15-04	"	D#2	0.70
15-05	"	E2	0.57
15-06	"	F2	0.57
15-07	"	F#2	0.60
15-08	"	G2, closed	0.80
15-09	"	G2, open	1.07
15-10	"	G#2	0.93
15-11	"	A2	1.00
15-12	"	A#2	0.97
15-13	"	B2	1.10
15-14	"	C3	1.30
15-15	"	C#3	1.70
15-16	"	D3, closed	1.07
15-17	"	D#3	1.37
15-18	"	E3	1.20
15-19	"	F3	1.17
15-20	"	F#3	1.10
15-21	"	G3	1.07
15-22	"	G#3	1.17
15-23	"	A3, closed	1.13
15-24	"	A#3	1.20
15-25	"	B3	1.37
15-26	"	C4	1.20
15-27	"	C#4	1.13

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
15-28	Cello, martelé	D4	1.27
15-29	"	D#4	1.13
15-30	"	E4	1.43
15-31	"	F4	0.90
15-32	"	F#4	1.47
15-33	"	G4	1.67
15-34	"	G#4	1.20
15-35	"	A4	1.60
15-36	"	A#4	1.43
15-37	"	B4	2.43
15-38	"	C5	1.37
15-39	"	C#5	1.30
15-40	"	D5	1.90
15-41	"	D#5	1.47
15-42	"	E5	1.67
15-43	"	F5	1.50
15-44	"	F#5	2.37
15-45	"	G5	1.83
16-01	Double bass, bowed	C1	5.23
16-02	"	C#1	4.60
16-03	"	D1	6.27
16-04	"	D#1	4.60
16-05	"	E1	4.67
16-06	"	F1	4.37
16-07	"	F#1	2.67
16-08	"	G1	2.87
16-09	"	G#1	4.07
16-10	"	A1, closed	2.83
16-11	"	A1, open	3.80
16-12	"	A#1	3.80
16-13	"	B1	4.33
16-14	"	C2	4.33
16-15	"	C#2	3.90
16-16	"	D2, closed	3.47
16-17	"	D2, open	3.63
16-18	"	D#2	3.67
16-19	"	E2	3.20
16-20	"	F2	3.90
16-21	"	F#2	4.30
16-22	"	G2, closed	3.53
16-23	"	G2, open	4.07

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
16-24	Double bass, bowed	G#2	3.47
16-25	"	A2	4.00
16-26	"	A#2	3.47
16-27	"	B2	3.27
16-28	"	C3	4.10
16-29	"	C#3	4.03
16-30	"	D3	4.00
16-31	"	D#3	3.97
16-32	"	E3	4.13
16-33	"	F3	3.83
16-34	"	F#3	4.30
16-35	"	G3	3.23
16-36	"	G#3	3.77
16-37	"	A3	4.10
16-38	"	A#3	3.70
16-39	"	B3	4.80
16-40	"	C4	3.83
16-41	"	C#4	4.13
16-42	"	D4	3.60
16-43	"	D#4	3.47
16-44	"	E4	3.03
17-01	Double bass, muted	C1	2.33
17-02	"	C#1	2.47
17-03	"	D1	2.60
17-04	"	D#1	2.47
17-05	"	E1	3.07
17-06	"	F1	2.13
17-07	"	F#1	2.77
17-08	"	G1	2.03
17-09	"	G#1	2.23
17-10	"	A1, closed	1.90
17-11	"	A1, open	3.07
17-12	"	A#1	1.60
17-13	"	B1	1.73
17-14	"	C2	1.70
17-15	"	C#2	1.63
17-16	"	D2, closed	1.93
17-17	"	D2, open	4.50
17-18	"	D#2	2.07
17-19	"	E2	2.23
17-20	"	F2	1.87

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
17-21	Double bass, muted	F#2	1.73
17-22	"	G2, closed	1.67
17-23	"	G2, open	9.60
17-24	"	G#2	4.90
17-25	"	A2	7.83
17-26	"	A#2	6.70
17-27	"	B2	6.57
17-28	"	C3	5.13
17-29	"	C#3	6.93
17-30	"	D3	4.67
17-31	"	D#3	6.37
17-32	"	E3	5.53
17-33	"	F3	4.00
17-34	"	F#3	4.77
17-35	"	G3	5.27
17-36	"	G#3	4.67
17-37	"	A3	5.73
17-38	"	A#3	4.30
17-39	"	B3	5.03
17-40	"	C4	3.33
17-41	"	C#4	3.70
17-42	"	D4	3.77
17-43	"	D#4	3.40
17-44	"	E4	5.93
17-45	"	F4	2.30
18-01	Double bass, pizzicato	C1	4.87
18-02	"	C#1	5.07
18-03	"	D1	5.83
18-04	"	D#1	6.57
18-05	"	E1	7.30
18-06	"	F1	5.13
18-07	"	F#1	2.13
18-08	"	G1	4.20
18-09	"	G#1	4.43
18-10	"	A1, closed	5.67
18-11	"	A#1	3.87
18-12	"	B1	5.90
18-13	"	C2	3.50
18-14	"	C#2	6.10
18-15	"	D2, closed	5.87
18-16	"	D#2	7.27

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
18-17	Double bass, pizzicato	E2	3.70
18-18	"	F2	5.13
18-19	"	F#2	5.20
18-20	"	G2, closed	7.97
18-21	"	G#2	5.83
18-22	"	A2	7.17
18-23	"	A#2	5.17
18-24	"	B2	6.10
18-25	"	C3	7.17
18-26	"	C#3	6.03
18-27	"	D3	2.00
18-28	"	D#3	2.53
18-29	"	E3	2.13
18-30	"	F3	2.03
18-31	"	F#3	1.73
18-32	"	G3	2.43
18-33	"	G#3	2.33
18-34	"	A3	1.47
18-35	"	A#3	2.63
18-36	"	B3	2.30
18-37	"	C4	2.53
18-38	"	C#4	3.47
18-39	"	D4	3.33
18-40	"	D#4	2.87
18-41	"	E4	2.20
18-42	"	F4	1.07
19-01	Double bass, natural harmonics	E2	3.33
19-02	"	B2	5.53
19-03	"	G#3	4.57
19-04	"	A2	6.17
19-05	"	E3	5.83
19-06	"	C#4	5.13
19-07	"	D3	6.20
19-08	"	A3	6.63
19-09	"	F#4	5.73
19-10	"	G3	6.40
19-11	"	D4	7.40
19-12	"	B4	1.33
20-01	Double bass, martelé	C1	1.90
20-02	"	C#1	2.67

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
20-03	Double bass, martelé	D1	2.33
20-04	"	D#1	1.67
20-05	"	E1	2.67
20-06	"	F1	1.83
20-07	"	F#1	0.90
20-08	"	G1	1.40
20-09	"	G#1	2.87
20-10	"	A1, closed	1.97
20-11	"	A#1	2.10
20-12	"	B1	1.77
20-13	"	C2	1.77
20-14	"	C#2	1.67
20-15	"	D2, closed	1.40
20-16	"	D#2	1.73
20-17	"	E2	1.97
20-18	"	F2	2.53
20-19	"	F#2	1.70
20-20	"	G2, closed	1.80
20-21	"	G#2	2.23
20-22	"	A2	2.33
20-23	"	A#2	1.27
20-24	"	B2	0.67
20-25	"	C3	1.77
20-26	"	C#3	1.93
20-27	"	D3	1.43
20-28	"	D#3	2.63
20-29	"	E3	2.17
20-30	"	F3	1.77
20-31	"	F#3	3.17
20-32	"	G3	1.33
20-33	"	G#3	2.33
20-34	"	A3	2.33
20-35	"	B3	1.67
20-36	"	C4	1.77
20-37	"	C#4	1.03
21-01	Violin ensemble, bowed	G3	8.13
21-02	"	G#3	5.77
21-03	"	A3	5.17
21-04	"	A#3	7.67
21-05	"	B3	6.03
21-06	"	C4	8.03

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
21-07	Violin, ensemble, bowed	C#4	6.17
21-08	"	D4, closed	8.70
21-09	"	D#4	6.10
21-10	"	E4	5.13
21-11	"	F4	5.53
21-12	"	F#4	4.83
21-13	"	G4	5.83
21-14	"	G#4	6.43
21-15	"	A4, closed	4.77
21-16	"	A#4	6.23
21-17	"	B4	9.17
21-18	"	C5	10.13
21-19	"	C#5	9.63
21-20	"	D5	8.97
21-21	"	D#5	5.23
21-22	"	E5, closed	7.47
21-23	"	F5	5.97
21-24	"	F#5	6.30
21-25	"	G5	7.13
21-26	"	G#5	8.27
21-27	"	A5	5.20
21-28	"	A#5	5.53
21-29	"	B5	5.80
21-30	"	C6	5.67
21-31	"	C#6	5.67
21-32	"	D6	5.60
21-33	"	D#6	5.03
21-34	"	E6	4.57
21-35	"	F6	4.93
21-36	"	F#6	4.80
21-37	"	G6	4.77
21-38	"	G#6	4.77
21-39	"	A6	5.13
21-40	"	A#6	4.60
21-41	"	B6	5.23
21-42	"	C7	5.17
21-43	"	C#7	5.53
21-44	"	D7	4.03
22-01	Violin ensemble, pizzicato	G3	4.33
22-02	"	G#3	4.17
22-03	"	B3	3.27

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
22-04	Violin ensemble, pizzicato	D4, closed	4.20
22-05	"	F4	3.40
22-06	"	G#4	3.40
22-07	"	A4, closed	2.80
22-08	"	A#4	3.03
22-09	"	B4	3.03
22-10	"	C5	3.83
22-11	"	C#5	3.07
22-12	"	D5	3.93
22-13	"	D#5	3.13
22-14	"	E5, closed	2.90
22-15	"	F5	4.73
22-16	"	F#5	3.40
22-17	"	G5	2.70
22-18	"	G#5	3.30
22-19	"	A5	2.20
22-20	"	A#5	3.80
22-21	"	B5	2.80
23-01	Violin ens., natural harmonics	G4	4.83
23-02	"	D5	7.43
23-03	"	B5	5.37
23-04	"	D5	6.97
23-05	"	A5	6.30
23-06	"	F#6	5.83
23-07	"	A5	6.97
23-08	"	E6	5.27
23-09	"	C#7	9.03
23-10	"	E6	8.80
23-11	"	B6	5.17
23-12	"	G#7	4.57
24-01	Violin ensemble, martelé	G3	3.03
24-02	"	A3	2.93
24-03	"	B3	3.07
24-04	"	C#4	2.97
24-05	"	D4, closed	2.87
24-06	"	E4	2.43
24-07	"	F#4	3.60
24-08	"	G#4	3.07
24-09	"	A4, closed	3.00
24-10	"	A#4	2.90

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
24-11	Violin ensemble, martelé	C5	3.70
24-12	"	C#5	2.73
24-13	"	D5	3.40
24-14	"	D#5	3.43
24-15	"	E5, closed	2.83
24-16	"	F5	2.97
24-17	"	F#5	3.47
24-18	"	G5	3.37
24-19	"	G#5	2.93
24-20	"	A5	3.97
24-21	"	A#5	3.47
24-22	"	B5	3.20
24-23	"	C6	3.33
24-24	"	C#6	4.53
24-25	"	D6	3.07
24-26	"	D#6	2.80
24-27	"	E6	2.17
24-28	"	F6	3.10
24-29	"	F#6	3.70
24-30	"	G6	3.50

VOLUME 2: WOODWINDS AND BRASS

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
01-01	Flute	C4	4.70
01-02	"	C#4	5.03
01-03	"	D4	4.60
01-04	"	D#4	4.20
01-05	"	E4	4.13
01-06	"	F4	3.30
01-07	"	F#4	5.20
01-08	"	G4	3.90
01-09	"	G#4	4.40
01-10	"	A4	4.27
01-11	"	A#4	3.77
01-12	"	B4	4.20
01-13	"	C5	4.07
01-14	"	C#5	5.00
01-15	"	D5	4.33
01-16	"	D#5	5.00
01-17	"	E5	3.93
01-18	"	F5	3.97
01-19	"	F#5	4.43
01-20	"	G5	3.87
01-21	"	G#5	5.13
01-22	"	A5	4.30
01-23	"	A#5	4.27
01-24	"	B5	4.30
01-25	"	C6	4.03
01-26	"	C#6	4.33
01-27	"	D6	3.97
01-28	"	D#6	4.77
01-29	"	E6	3.70
01-30	"	F6	4.20
01-31	"	F#6	4.37
01-32	"	G6	3.80
01-33	"	G#6	3.83
01-34	"	A6	3.93
01-35	"	A#6	3.33
01-36	"	B6	4.37
01-37	"	C7	3.80

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
02-01	Flute, flutter-tonguing	C4	6.57
02-02	"	C#4	6.97
02-03	"	D4	6.10
02-04	"	D#4	6.43
02-05	"	E4	6.57
02-06	"	F4	5.70
02-07	"	F#4	5.73
02-08	"	G4	6.03
02-09	"	G#4	5.57
02-10	"	A4	7.20
02-11	"	A#4	6.77
02-12	"	B4	4.27
02-13	"	C5	5.27
02-14	"	C#5	5.20
02-15	"	D5	7.87
02-16	"	D#5	5.90
02-17	"	E5	5.23
02-18	"	F5	5.60
02-19	"	F#5	4.40
02-20	"	G5	5.33
02-21	"	G#5	6.07
02-22	"	A5	5.20
02-23	"	A#5	5.73
02-24	"	B5	5.63
02-25	"	C6	5.17
02-26	"	C#6	5.00
02-27	"	D6	4.73
02-28	"	D#6	5.40
02-29	"	E6	5.17
03-01	Piccolo	D5	3.50
03-02	"	D#5	3.83
03-03	"	E5	2.63
03-04	"	F5	3.10
03-05	"	F#5	2.60
03-06	"	G5	2.97
03-07	"	G#5	3.83
03-08	"	A5	3.23
03-09	"	A#5	3.37
03-10	"	B5	3.17
03-11	"	C6	3.23
03-12	"	C#6	3.10

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
03-13	Piccolo	D6	2.70
03-14	"	D#6	2.97
03-15	"	E6	2.90
03-16	"	F6	2.43
03-17	"	F#6	3.00
03-18	"	G6	3.63
03-19	"	G#6	2.93
03-20	"	A6	3.23
03-21	"	A#6	3.07
03-22	"	B6	3.27
03-23	"	C7	3.30
03-24	"	C#7	3.70
03-25	"	D7	3.10
03-26	"	D#7	3.17
03-27	"	E7	3.33
03-28	"	F7	3.67
03-29	"	F#7	2.47
03-30	"	G7	2.63
04-01	Piccolo, flutter-tonguing	D5	5.27
04-02	"	D#5	7.20
04-03	"	E5	7.57
04-04	"	F5	4.77
04-05	"	F#5	5.30
04-06	"	G5	6.07
04-07	"	G#5	6.87
04-08	"	A5	6.97
04-09	"	A#5	7.00
04-10	"	B5	6.43
04-11	"	C6	7.20
04-12	"	C#6	6.77
04-13	"	D6	6.17
04-14	"	D#6	5.90
04-15	"	E6	2.93
04-16	"	F6	3.83
04-17	"	F#6	4.17
04-18	"	G6	4.17
04-19	"	G#6	3.27
04-20	"	A6	3.73
04-21	"	A#6	3.23
04-22	"	B6	3.30
04-23	"	C7	3.07

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
04-24	Piccolo, flutter-tonguing	C#7	2.40
05-01	Alto flute	G3	3.43
05-02	"	G#3	3.57
05-03	"	A3	3.27
05-04	"	A#3	2.57
05-05	"	B3	3.63
05-06	"	C4	2.67
05-07	"	C#4	3.53
05-08	"	D4	3.13
05-09	"	D#4	3.13
05-10	"	E4	3.50
05-11	"	F4	3.90
05-12	"	F#4	3.97
05-13	"	G4	4.53
05-14	"	G#4	3.50
05-15	"	A4	5.40
05-16	"	A#4	2.83
05-17	"	B4	3.07
05-18	"	C4	3.27
05-19	"	C#4	3.43
05-20	"	D4	4.03
05-21	"	D#4	4.37
05-22	"	E4	3.17
05-23	"	F4	3.93
05-24	"	F#4	4.00
05-25	"	G4	4.33
05-26	"	G#4	4.00
05-27	"	A4	3.80
05-28	"	A#4	4.33
05-29	"	B4	3.47
05-30	"	C4	3.63
06-01	Bass flute	C3	4.00
06-02	"	C#3	5.50
06-03	"	D3	5.27
06-04	"	D#3	4.80
06-05	"	E3	4.13
06-06	"	F3	4.83
06-07	"	F#3	5.03
06-08	"	G3	5.03
06-09	"	G#3	5.13

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
06-10	Bass flute	A3	6.03
06-11	"	A#3	5.80
06-12	"	B3	5.27
06-13	"	C4	5.03
06-14	"	C#4	4.23
06-15	"	D4	4.13
06-16	"	D#4	3.93
06-17	"	E4	3.80
06-18	"	F4	4.03
06-19	"	F#4	4.67
06-20	"	G4	4.20
06-21	"	G#4	4.67
06-22	"	A4	5.17
06-23	"	A#4	4.63
06-24	"	B4	3.87
06-25	"	C5	4.73
06-26	"	C#5	3.90
07-01	Bass flute, flutter-tonguing	C3	3.80
07-02	"	C#3	4.03
07-03	"	D3	3.60
07-04	"	D#3	2.90
07-05	"	E3	2.90
07-06	"	F3	2.90
07-07	"	F#3	2.73
07-08	"	G3	2.87
07-09	"	G#3	2.67
07-10	"	A3	2.53
07-11	"	A#3	3.20
07-12	"	B3	3.50
07-13	"	C4	2.07
07-14	"	C#4	3.13
07-15	"	D4	3.83
07-16	"	D#4	3.07
08-01	Oboe	A#3	4.60
08-02	"	B3	4.40
08-03	"	C4	4.30
08-04	"	C#4	3.27
08-05	"	D4	4.23
08-06	"	D#4	4.53
08-07	"	E4	2.87

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
08-08	Oboe	F4	3.17
08-09	"	F#4	3.40
08-10	"	G4	3.83
08-11	"	G#4	2.90
08-12	"	A4	3.53
08-13	"	A#4	3.97
08-14	"	B4	3.60
08-15	"	C5	4.10
08-16	"	C#5	3.10
08-17	"	D5	3.40
08-18	"	D#5	2.97
08-19	"	E5	3.20
08-20	"	F5	3.73
08-21	"	F#5	3.13
08-22	"	G5	4.83
08-23	"	G#5	3.43
08-24	"	A5	3.07
08-25	"	A#5	4.50
08-26	"	B5	4.10
08-27	"	C6	3.37
08-28	"	C#6	3.63
08-29	"	D6	3.33
08-30	"	D#6	4.57
08-31	"	E6	2.63
08-32	"	F6	2.93
09-01	English horn	E3	3.33
09-02	"	F3	4.53
09-03	"	F#3	3.60
09-04	"	G3	3.80
09-05	"	G#3	3.50
09-06	"	A3	4.13
09-07	"	A#3	2.83
09-08	"	B3	3.83
09-09	"	C4	3.53
09-10	"	C#4	3.53
09-11	"	D4	4.50
09-12	"	D#4	3.93
09-13	"	E4	3.33
09-14	"	F4	3.87
09-15	"	F#4	3.57
09-16	"	G4	4.03

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
09-17	English horn	G#4	3.67
09-18	"	A4	3.63
09-19	"	A#4	3.43
09-20	"	B4	3.70
09-21	"	C5	3.87
09-22	"	C#5	5.83
09-23	"	D5	3.63
09-24	"	D#5	4.13
09-25	"	E5	4.30
09-26	"	F5	4.97
09-27	"	F#5	3.60
09-28	"	G5	3.30
09-29	"	G#5	3.70
09-30	"	A5	3.53
10-01	B flat clarinet	D3	5.80
10-02	"	D#3	3.67
10-03	"	E3	4.80
10-04	"	F3	5.17
10-05	"	F#3	3.77
10-06	"	G3	4.07
10-07	"	G#3	4.10
10-08	"	A3	4.27
10-09	"	A#3	3.97
10-10	"	B3	3.83
10-11	"	C4	4.50
10-12	"	C#4	3.90
10-13	"	D4	4.13
10-14	"	D#4	4.90
10-15	"	E4	4.20
10-16	"	F4	4.63
10-17	"	F#4	3.87
10-18	"	G4	5.03
10-19	"	G#4	4.27
10-20	"	A4	4.40
10-21	"	A#4	5.63
10-22	"	B4	5.03
10-23	"	C5	4.40
10-24	"	C#5	4.13
10-25	"	D5	4.60
10-26	"	D#5	4.27
10-27	"	E5	5.20

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
10-28	B flat clarinet	F5	4.53
10-29	"	F#5	3.60
10-30	"	G5	5.67
10-31	"	G#5	4.60
10-32	"	A5	4.93
10-33	"	A#5	4.90
10-34	"	B5	5.10
10-35	"	C6	4.67
10-36	"	C#6	4.53
10-37	"	D6	4.30
11-01	E flat clarinet	G3	4.67
11-02	"	G#3	5.77
11-03	"	A3	5.97
11-04	"	A#3	4.80
11-05	"	B3	5.53
11-06	"	C4	6.40
11-07	"	C#4	5.57
11-08	"	D4	4.97
11-09	"	D#4	4.10
11-10	"	E4	4.47
11-11	"	F4	4.90
11-12	"	F#4	4.00
11-13	"	G4	4.00
11-14	"	G#4	5.00
11-15	"	A4	3.87
11-16	"	A#4	4.67
11-17	"	B4	4.77
11-18	"	C4	3.77
11-19	"	C#4	3.40
11-20	"	D4	3.93
11-21	"	D#4	5.80
11-22	"	E4	3.90
11-23	"	F4	5.20
11-24	"	F#4	5.10
11-25	"	G4	4.53
11-26	"	G#4	4.53
11-27	"	A4	3.53
11-28	"	A#4	3.70
11-29	"	B4	3.37
11-30	"	C5	4.70
11-31	"	C#5	4.03

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
11-32	E flat clarinet	D5	3.83
12-01	Bass clarinet	C#2	4.97
12-02	"	D2	3.67
12-03	"	D#2	3.77
12-04	"	E2	3.63
12-05	"	F2	4.63
12-06	"	F#2	4.37
12-07	"	G2	4.23
12-08	"	G#2	4.07
12-09	"	A2	2.83
12-10	"	A#2	2.77
12-11	"	B2	2.53
12-12	"	C3	3.40
12-13	"	C#3	3.47
12-14	"	D3	3.27
12-15	"	D#3	3.40
12-16	"	E3	3.60
12-17	"	F3	3.27
12-18	"	F#3	4.10
12-19	"	G3	3.27
12-20	"	G#3	2.87
12-21	"	A3	3.73
12-22	"	A#3	3.50
12-23	"	B3	4.67
12-24	"	C4	4.17
12-25	"	C#4	3.90
13-01	Contrabass clarinet	F#1	4.63
13-02	"	G1	3.70
13-03	"	G#1	3.43
13-04	"	A1	4.10
13-05	"	A#1	4.00
13-06	"	B1	5.03
13-07	"	C2	4.13
13-08	"	C#2	3.97
13-09	"	D2	4.83
13-10	"	D#2	4.90
13-11	"	E2	4.20
13-12	"	F2	4.17
13-13	"	F#2	4.17
13-14	"	G2	4.37

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
13-15	Contrabass clarinet	G#2	4.70
13-16	"	A2	3.93
13-17	"	A#2	5.00
13-18	"	B2	4.73
13-19	"	C3	3.27
13-20	"	C#3	3.93
13-21	"	D3	3.23
13-22	"	D#3	3.37
13-23	"	E3	3.97
13-24	"	F3	4.37
13-25	"	F#3	3.77
14-01	Bassoon	A#1	4.87
14-02	"	B1	5.17
14-03	"	C2	5.03
14-04	"	C#2	5.93
14-05	"	D2	9.77
14-06	"	D#2	6.57
14-07	"	E2	6.93
14-08	"	F2	6.57
14-09	"	F#2	5.80
14-10	"	G2	6.83
14-11	"	G#2	5.37
14-12	"	A2	5.83
14-13	"	A#2	5.03
14-14	"	B2	5.47
14-15	"	C3	6.07
14-16	"	C#3	5.97
14-17	"	D3	5.70
14-18	"	D#3	4.97
14-19	"	E3	6.00
14-20	"	F3	7.60
14-21	"	F#3	5.73
14-22	"	G3	6.93
14-23	"	G#3	4.87
14-24	"	A3	5.90
14-25	"	A#3	4.60
14-26	"	B3	6.40
14-27	"	C4	5.90
14-28	"	C#4	4.30
14-29	"	D4	5.27
14-30	"	D#4	4.83

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
14-31	Bassoon	E4	5.00
14-32	"	F4	5.50
15-01	Contrabassoon	A#0	4.47
15-02	"	B0	4.77
15-03	"	C1	4.07
15-04	"	C#1	5.33
15-05	"	D1	3.93
15-06	"	D#1	4.07
15-07	"	E1	4.30
15-08	"	F1	4.47
15-09	"	F#1	6.07
15-10	"	G1	4.90
15-11	"	G#1	5.73
15-12	"	A1	3.23
15-13	"	A#1	5.33
15-14	"	B1	4.97
15-15	"	C2	6.33
15-16	"	C#2	5.00
15-17	"	D2	4.83
15-18	"	D#2	4.57
15-19	"	E2	5.10
15-20	"	F2	4.23
15-21	"	F#2	4.97
15-22	"	G2	5.20
15-23	"	G#2	4.80
15-24	"	A2	6.43
15-25	"	A#2	5.40
15-26	"	B2	5.10
15-27	"	C3	4.47
15-28	"	C#3	5.70
15-29	"	D3	5.03
15-30	"	D#3	5.67
15-31	"	E3	5.83
15-32	"	F3	5.33
16-01	C trumpet	F#3	5.63
16-02	"	G3	5.40
16-03	"	G#3	6.77
16-04	"	A3	6.33
16-05	"	A#3	6.70
16-06	"	B3	6.77

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
16-07	C trumpet	C4	7.73
16-08	"	C#4	8.30
16-09	"	D4	8.07
16-10	"	D#4	3.63
16-11	"	E4	7.63
16-12	"	F4	8.07
16-13	"	F#4	7.60
16-14	"	G4	7.90
16-15	"	G#4	7.07
16-16	"	A4	5.90
16-17	"	A#4	7.30
16-18	"	B4	7.23
16-19	"	C5	8.50
16-20	"	C#5	7.77
16-21	"	D5	6.87
16-22	"	D#5	6.37
16-23	"	E5	6.77
16-24	"	F5	5.60
16-25	"	F#5	7.20
16-26	"	G5	6.50
16-27	"	G#5	5.67
16-28	"	A5	5.50
16-29	"	A#5	6.10
16-30	"	B5	6.80
16-31	"	C6	7.43
16-32	"	C#6	2.93
16-33	"	D6	6.90
16-34	"	D#6	5.77
17-01	C tpt., Harmon mute with stem out	F#3	5.73
17-02	"	G3	5.93
17-03	"	G#3	5.13
17-04	"	A3	4.83
17-05	"	A#3	6.53
17-06	"	B3	5.47
17-07	"	C4	5.47
17-08	"	C#4	7.57
17-09	"	D4	5.43
17-10	"	D#4	5.73
17-11	"	E4	6.27
17-12	"	F4	6.13
17-13	"	F#4	6.90

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
17-14	C tpt., Harmon mute with stem out	G4	4.74
17-15	"	G#4	7.23
17-16	"	A4	6.13
17-17	"	A#4	4.97
17-18	"	B4	6.73
17-19	"	C5	2.23
17-20	"	C#5	7.83
17-21	"	D5	5.67
17-22	"	D#5	7.13
17-23	"	E5	4.50
17-24	"	F5	3.93
17-25	"	F#5	5.50
17-26	"	G5	4.63
17-27	"	G#5	4.80
17-28	"	A5	4.00
17-29	"	A#5	4.27
17-30	"	B5	4.07
17-31	"	C6	3.83
18-01	Bach trumpet	B3	4.53
18-02	"	C4	4.73
18-03	"	C#4	4.80
18-04	"	D4	3.80
18-05	"	D#4	4.37
18-06	"	E4	4.57
18-07	"	F4	4.63
18-08	"	F#4	2.77
18-09	"	G4	4.23
18-10	"	G#4	2.90
18-11	"	A4	5.10
18-12	"	B4	5.80
18-13	"	C5	5.40
18-14	"	C#5	4.43
18-15	"	D5	4.77
18-16	"	D#5	3.13
18-17	"	E5	4.70
18-18	"	F5	6.43
18-19	"	F#5	5.10
18-20	"	G5	5.00
18-21	"	G#5	4.97
18-22	"	A5	5.33
18-23	"	A#5	5.17

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
18-24	Bach trumpet	B5	3.87
18-25	"	C5	4.37
18-26	"	C#6	5.90
18-27	"	D6	4.03
18-28	"	D#6	5.23
18-29	"	E6	3.83
18-30	"	F6	5.33
18-31	"	F#6	2.27
18-32	"	G6	3.80
19-01	French horn	D2	3.87
19-02	"	D#2	2.90
19-03	"	E2	3.37
19-04	"	F2	2.73
19-05	"	F#2	3.00
19-06	"	G2	3.27
19-07	"	G#2	4.00
19-08	"	A2	3.87
19-09	"	A#2	3.07
19-10	"	B2	3.33
19-11	"	C3	2.87
19-12	"	C#3	2.57
19-13	"	D3	2.93
19-14	"	D#3	2.60
19-15	"	E3	2.43
19-16	"	F3	3.57
19-17	"	F#3	3.20
19-18	"	G3	3.33
19-19	"	G#3	3.03
19-20	"	A3	2.70
19-21	"	A#3	2.23
19-22	"	B3	3.13
19-23	"	C4	2.73
19-24	"	C#4	2.87
19-25	"	D4	2.97
19-26	"	D#4	2.70
19-27	"	E4	3.33
19-28	"	F4	2.07
19-29	"	F#4	2.63
19-30	"	G4	1.67
19-31	"	G#4	2.17
19-32	"	A4	3.37

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
19-33	French horn	A#4	1.90
19-34	"	B4	3.43
19-35	"	C5	2.67
19-36	"	C#5	3.40
19-37	"	D5	2.27
20-01	French horn, muted	D2	3.37
20-02	"	D#2	2.27
20-03	"	E2	2.03
20-04	"	F2	3.07
20-05	"	F#2	2.87
20-06	"	G2	2.63
20-07	"	G#2	3.10
20-08	"	A2	1.97
20-09	"	A#2	2.03
20-10	"	B2	2.13
20-11	"	C3	2.60
20-12	"	C#3	2.13
20-13	"	D3	2.73
20-14	"	D#3	2.60
20-15	"	E3	2.60
20-16	"	F3	2.57
20-17	"	F#3	1.87
20-18	"	G3	2.07
20-19	"	G#3	2.50
20-20	"	A3	2.30
20-21	"	A#3	2.10
20-22	"	B3	2.03
20-23	"	C4	1.53
20-24	"	C#4	2.33
20-25	"	D4	1.73
20-26	"	D#4	2.30
20-27	"	E4	2.27
20-28	"	F4	1.80
20-29	"	F#4	2.17
20-30	"	G4	2.90
20-31	"	G#4	2.90
20-32	"	A4	2.80
20-33	"	A#4	3.27
20-34	"	B4	1.93
20-35	"	C5	4.30
20-36	"	C#5	3.50

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
20-37	French horn, muted	D5	1.87
21-01	Alto trombone	F4	2.33
21-02	"	F#3	1.90
21-03	"	G3	3.50
21-04	"	G#3	2.80
21-05	"	A3	3.03
21-06	"	A#3	2.90
21-07	"	B3	3.53
21-08	"	C4	2.37
21-09	"	C#4	3.40
21-10	"	D4	2.23
21-11	"	D#4	2.60
21-12	"	E4	2.03
21-13	"	F4	3.17
22-01	Tenor trombone	E2	3.20
22-02	"	F2	2.00
22-03	"	F#2	2.20
22-04	"	G2	3.47
22-05	"	G#2	3.06
22-06	"	A2	1.73
22-07	"	A#2	3.17
22-08	"	B2	3.00
22-09	"	C3	2.43
22-10	"	C#3	3.47
22-11	"	D3	3.10
22-12	"	D#3	2.37
22-13	"	E3	2.90
22-14	"	F3	2.73
22-15	"	F#3	2.33
22-16	"	G3	2.27
22-17	"	G#3	3.17
22-18	"	A3	3.63
22-19	"	A#3	3.30
22-20	"	B3	2.83
22-21	"	C4	2.47
22-22	"	C#4	2.47
22-23	"	D4	3.63
22-24	"	D#4	4.47
22-25	"	E4	4.30
22-26	"	F4	4.00

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
22-27	Tenor trombone	F#4	4.23
22-28	"	G4	3.83
22-29	"	G#4	3.50
22-30	"	A4	3.90
22-31	"	A#4	2.77
22-32	"	B4	2.43
22-33	"	C5	3.43
22-34	"	C#5	3.23
22-35	"	D5	3.43
22-36	"	D#5	1.87
23-01	Tenor trombone, muted	E2	3.37
23-02	"	F2	2.83
23-03	"	F#2	2.57
23-04	"	G2	2.33
23-05	"	G#2	2.23
23-06	"	A2	2.50
23-07	"	A#2	2.73
23-08	"	B2	2.80
23-09	"	C3	2.33
23-10	"	C#3	2.47
23-11	"	D3	2.80
23-12	"	D#3	3.47
23-13	"	E3	3.30
23-14	"	F3	2.93
23-15	"	F#3	3.47
23-16	"	G3	3.63
23-17	"	G#3	3.00
23-18	"	A3	3.90
23-19	"	A#3	4.07
23-20	"	B3	3.47
23-21	"	C4	2.93
23-22	"	C#4	2.63
23-23	"	D4	2.57
23-24	"	D#4	2.63
23-25	"	E4	2.03
23-26	"	F4	2.80
23-27	"	F#4	3.57
23-28	"	G4	1.90
23-29	"	G#4	3.90
23-30	"	A4	1.97
23-31	"	A#4	2.73

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
23-32	Tenor trombone, muted	B4	2.30
23-33	"	C5	1.30
24-01	Bass trombone	F1	2.83
24-02	"	F#1	4.10
24-03	"	G1	2.63
24-04	"	G#1	3.30
24-05	"	A1	2.13
24-06	"	A#1	2.43
24-07	"	B1	2.70
24-08	"	C2	2.87
24-09	"	C#2	2.13
24-10	"	D2	2.80
24-11	"	D#2	2.37
24-12	"	E2	3.63
24-13	"	F2	3.20
24-14	"	F#2	2.00
24-15	"	G2	3.27
24-16	"	G#2	4.03
24-17	"	A2	2.73
24-18	"	A#2	3.90
24-19	"	B2	3.17
24-20	"	C3	3.07
24-21	"	C#3	2.53
24-22	"	D3	3.50
24-23	"	D#3	2.33
24-24	"	E3	3.80
24-25	"	F3	2.17
25-01	Tuba	C2	6.73
25-02	"	C#2	8.30
25-03	"	D2	8.30
25-04	"	D#2	7.67
25-05	"	F2	7.57
25-06	"	F#2	7.53
25-07	"	G2	7.60
25-08	"	G#2	5.30
25-09	"	A2	5.07
25-10	"	A#2	5.40
25-11	"	B2	5.27
25-12	"	C3	6.23
25-13	"	C#3	7.07

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
25-14	Tuba	D3	6.33
25-15	"	D#3	7.33
25-16	"	E3	6.47
25-17	"	F3	6.77
25-18	"	F#3	6.10
25-19	"	G3	7.00
25-20	"	G#3	6.47
25-21	"	A3	5.87
25-22	"	A#3	5.77
25-23	"	B3	6.40
25-24	"	C4	7.13
25-25	"	C#4	7.03
25-26	"	D4	6.47
25-27	"	D#4	7.13
25-28	"	E4	6.77
25-29	"	F4	7.10
25-30	"	F#4	8.10
25-31	"	G4	11.03
25-32	Tuba pedal note	E1	2.83
26-01	Trombone pedal notes	A#1	3.13
26-02	"	A1	4.77
26-03	"	G#1	6.43
26-04	"	G1	4.43
26-05	"	F#1	4.03
26-06	"	F1	2.93

VOLUME 3: PIANO, PERCUSSION, AND SAXOPHONES

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
01-01	9' Steinway grand piano, soft	A0	12.53
01-02	"	A#0	14.27
01-03	"	B0	16.90
01-04	"	C1	15.33
01-05	"	C#1	15.80
01-06	"	D1	13.30
01-07	"	D#1	15.13
01-08	"	E1	16.33
01-09	"	F1	14.70
01-10	"	F#1	11.97
01-11	"	G1	15.43
01-12	"	G#1	16.40
01-13	"	A1	15.17
01-14	"	A#1	15.83
01-15	"	B1	23.60
01-16	"	C2	18.70
01-17	"	C#2	18.97
01-18	"	D2	19.07
01-19	"	D#2	20.23
01-20	"	E2	20.40
01-21	"	F2	18.53
01-22	"	F#2	18.07
01-23	"	G2	17.97
01-24	"	G#2	22.47
01-25	"	A2	23.47
01-26	"	A#2	14.23
01-27	"	B2	15.37
01-28	"	C3	16.50
01-29	"	C#3	17.50
01-30	"	D3	21.47
01-31	"	D#3	16.13
01-32	"	E3	17.37
01-33	"	F3	14.40
01-34	"	F#3	19.70
01-35	"	G3	17.27
01-36	"	G#3	18.07

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
01-37	9' Steinway grand piano, soft	A3	14.40
01-38	"	A#3	13.37
01-39	"	B3	12.23
01-40	"	C4	11.40
01-41	"	C#4	13.27
01-42	"	D4	9.57
01-43	"	D#4	10.77
01-44	"	E4	11.60
01-45	"	F4	12.23
01-46	"	F#4	9.83
01-47	"	G4	11.17
01-48	"	G#4	11.17
01-49	"	A4	10.00
01-50	"	A#4	10.43
01-51	"	B4	7.67
01-52	"	C5	10.23
01-53	"	C#5	9.83
01-54	"	D5	8.63
01-55	"	D#5	10.00
01-56	"	E5	8.33
01-57	"	F5	9.90
01-58	"	F#5	9.67
01-59	"	G5	7.67
01-60	"	G#5	8.63
01-61	"	A5	7.10
01-62	"	A#5	8.17
01-63	"	B5	9.00
01-64	"	C6	6.67
01-65	"	C#6	6.27
01-66	"	D6	7.83
01-67	"	D#6	5.50
01-68	"	E6	5.60
01-69	"	F6	5.83
01-70	"	F#6	6.30
01-71	"	G6	4.40
01-72	"	G#6	5.00
01-73	"	A6	4.70
01-74	"	A#6	3.50
01-75	"	B6	4.40
01-76	"	C7	3.30
01-77	"	C#7	4.33
01-78	"	D7	4.10

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
01-79	9' Steinway grand piano, soft	D#7	3.40
01-80	"	E7	4.83
01-81	"	F7	3.90
01-82	"	F#7	2.70
01-83	"	G7	2.70
01-84	"	G#7	3.30
01-85	"	A7	2.33
01-86	"	A#7	2.10
01-87	"	B7	2.63
01-88	"	C8	1.40
02-01	9' Hamburg Steinway, loud	A0	5.73
02-02	"	A#0	5.03
02-03	"	B0	6.20
02-04	"	C1	4.83
02-05	"	C#1	6.00
02-06	"	D1	4.97
02-07	"	D#1	6.90
02-08	"	E1	5.13
02-09	"	F1	3.97
02-10	"	F#1	4.97
02-11	"	G1	5.23
02-12	"	G#1	4.97
02-13	"	A1	5.07
02-14	"	A#1	6.13
02-15	"	B1	5.03
02-16	"	C2	3.90
02-17	"	C#2	5.67
02-18	"	D2	5.07
02-19	"	D#2	5.10
02-20	"	E2	5.10
02-21	"	F2	5.77
02-22	"	F#2	5.17
02-23	"	G2	5.30
02-24	"	G#2	4.93
02-25	"	A2	4.60
02-26	"	A#2	6.27
02-27	"	B2	6.00
02-28	"	C3	4.77
02-29	"	C#3	4.83
02-30	"	D3	5.20
02-31	"	D#3	5.17

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
02-32	9' Hamburg Steinway, loud	E3	5.20
02-33	"	F3	4.83
02-34	"	F#3	5.07
02-35	"	G3	5.93
02-36	"	G#3	6.77
02-37	"	A3	5.30
02-38	"	A#3	4.80
02-39	"	B3	5.03
02-40	"	C4	4.87
02-41	"	C#4	5.07
02-42	"	D4	5.23
02-43	"	D#4	5.00
02-44	"	E4	5.13
02-45	"	F4	4.77
02-46	"	F#4	5.17
02-47	"	G4	5.07
02-48	"	G#4	5.17
02-49	"	A4	4.40
02-50	"	A#4	5.40
02-51	"	B4	5.33
02-52	"	C5	4.93
02-53	"	C#5	4.87
02-54	"	D5	5.97
02-55	"	D#5	5.03
02-56	"	E5	4.93
02-57	"	F5	4.90
02-58	"	F#5	6.07
02-59	"	G5	4.93
02-60	"	G#5	5.87
02-61	"	A5	5.00
02-62	"	A#5	4.77
02-63	"	B5	5.40
02-64	"	C6	4.73
02-65	"	C#6	7.80
02-66	"	D6	5.07
02-67	"	D#6	4.90
02-68	"	E6	4.32
02-69	"	F6	4.87
02-70	"	F#6	6.10
02-71	"	G6	4.97
02-72	"	G#6	5.03
02-73	"	A6	4.83

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
02-74	9' Hamburg Steinway, loud	A#6	5.83
02-75	"	B6	5.07
02-76	"	C7	4.87
02-77	"	C#7	5.17
02-78	"	D7	4.83
02-79	"	D#7	5.10
02-80	"	E7	5.17
02-81	"	F7	5.10
02-82	"	F#7	5.07
02-83	"	G7	4.80
02-84	"	G#7	5.03
02-85	"	A7	4.80
02-86	"	A#7	4.70
02-87	"	B7	5.37
02-88	"	C8	1.13
03-01	9' Steinway grand piano, plucked	A0	9.87
03-02	"	A#0	8.80
03-03	"	B0	7.07
03-04	"	C1	7.03
03-05	"	C#1	7.27
03-06	"	D1	8.63
03-07	"	D#1	10.93
03-08	"	E1	8.13
03-09	"	F1	9.63
03-10	"	F#1	9.67
03-11	"	G1	8.47
03-12	"	G#1	10.57
03-13	"	A1	9.70
03-14	"	A#1	8.00
03-15	"	B1	7.70
03-16	"	C2	9.67
03-17	"	C#2	10.40
03-18	"	D2	9.27
03-19	"	D#2	9.23
03-20	"	E2	12.27
03-21	"	F2	9.30
03-22	"	F#2	6.33
03-23	"	G2	7.63
03-24	"	G#2	8.57
03-25	"	A2	8.47
03-26	"	A#2	8.83

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
03-27	9' Steinway grand piano, plucked	B2	8.60
03-28	"	C3	8.93
03-29	"	C#3	8.83
03-30	"	D3	9.37
03-31	"	D#3	7.10
03-32	"	E3	7.60
03-33	"	F3	7.27
03-34	"	F#3	7.97
03-35	"	G3	8.67
03-36	"	G#3	7.80
03-37	"	A3	5.90
03-38	"	A#3	6.50
03-39	"	B3	7.27
03-40	"	C4	6.40
03-41	"	C#4	6.10
03-42	"	D4	6.67
03-43	"	D#4	5.87
03-44	"	E4	8.13
03-45	"	F4	6.50
03-46	"	F#4	5.83
03-47	"	G4	5.87
03-48	"	G#4	6.40
03-49	"	A4	8.37
03-50	"	A#4	6.57
03-51	"	B4	5.17
03-52	"	C5	5.83
03-53	"	C#5	7.00
03-54	"	D5	7.70
03-55	"	D#5	8.70
03-56	"	E5	7.60
03-57	"	F5	6.83
03-58	"	F#5	6.63
03-59	"	G5	7.63
03-60	"	G#5	6.47
03-61	"	A5	5.10
03-62	"	A#5	6.63
03-63	"	B5	6.20
03-64	"	C6	5.83
03-65	"	C#6	6.43
03-66	"	D6	6.73
03-67	"	D#6	4.10
03-68	"	E6	4.47

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
03-69	9' Steinway grand piano, plucked	F6	3.70
03-70	"	F#6	4.87
03-71	"	G6	4.93
03-72	"	G#6	3.10
03-73	"	A6	5.13
03-74	"	A#6	3.63
03-75	"	B6	3.10
03-76	"	C7	3.47
03-77	"	C#7	3.00
03-78	"	D7	3.20
03-79	"	D#7	3.13
03-80	"	E7	2.67
03-81	"	F7	1.70
03-82	"	F#7	2.00
03-83	"	G7	1.80
03-84	"	G#7	2.40
03-85	"	A7	2.67
03-86	"	A#7	1.83
03-87	"	B7	1.67
03-88	"	C8	1.07
04-01	Grand symphonic marimba	F2	4.23
04-02	"	F#2	2.00
04-03	"	G2	1.73
04-04	"	G#2	2.33
04-05	"	A2	2.23
04-06	"	A#2	2.57
04-07	"	B2	2.20
04-08	"	C3	2.27
04-09	"	C#3	2.10
04-10	"	D3	2.93
04-11	"	D#3	2.03
04-12	"	E3	2.13
04-13	"	F3	2.87
04-14	"	F#3	3.30
04-15	"	G3	2.77
04-16	"	G#3	1.97
04-17	"	A3	2.23
04-18	"	A#3	2.73
04-19	"	B3	2.60
04-20	"	C4	3.03
04-21	"	C#4	1.93

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
04-22	Grand symphonic marimba	D4	2.30
04-23	"	D#4	2.07
04-24	"	E4	2.13
04-25	"	F4	2.07
04-26	"	F#4	1.93
04-27	"	G4	1.87
04-28	"	G#4	1.57
04-29	"	A4	1.47
04-30	"	A#4	1.70
04-31	"	B4	1.73
04-32	"	C5	1.43
04-33	"	C#5	1.97
04-34	"	D5	1.50
04-35	"	D#5	1.87
04-36	"	E5	1.47
04-37	"	F5	1.73
04-38	"	F#5	1.17
04-39	"	G5	1.40
04-40	"	G#5	1.50
04-41	"	A5	1.27
04-42	"	A#5	1.10
04-43	"	B5	0.93
04-44	"	C6	0.93
04-45	"	C#6	1.80
04-46	"	D6	1.40
04-47	"	D#6	1.00
04-48	"	E6	1.40
04-49	"	F6	0.87
04-50	"	F#6	2.40
04-51	"	G6	1.60
04-52	"	G#6	1.50
04-53	"	A6	0.97
04-54	"	A#6	0.90
04-55	"	B6	0.73
04-56	"	C7	0.53
05-01	Xylophone	F4	1.30
05-02	"	F#4	1.47
05-03	"	G4	1.83
05-04	"	G#4	3.57
05-05	"	A4	1.93
05-06	"	A#4	1.40

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
05-07	Xylophone	B4	1.70
05-08	"	C5	1.73
05-09	"	C#5	1.37
05-10	"	D5	0.97
05-11	"	D#5	2.20
05-12	"	E5	1.73
05-13	"	F5	1.80
05-14	"	F#5	1.47
05-15	"	G5	1.57
05-16	"	G#5	2.47
05-17	"	A5	1.73
05-18	"	A#5	1.67
05-19	"	B5	1.47
05-20	"	C6	1.63
05-21	"	C#6	1.53
05-22	"	D6	1.63
05-23	"	D#6	1.50
05-24	"	E6	1.43
05-25	"	F6	2.07
05-26	"	F#6	1.17
05-27	"	G6	1.33
05-28	"	G#6	1.50
05-29	"	A6	1.33
05-30	"	A#6	1.47
05-31	"	B6	1.17
05-32	"	C7	1.00
05-33	"	C#7	1.30
05-34	"	D7	1.27
05-35	"	D#7	0.90
05-36	"	E7	3.47
05-37	"	F7	0.97
05-38	"	F#7	1.03
05-39	"	G7	1.20
05-40	"	G#7	0.97
05-41	"	A7	0.97
05-42	"	A#7	0.83
05-43	"	B7	0.87
05-44	"	C8	0.53
06-01	Vibraphone, hard mallet	F4	2.00
06-02	"	F#4	2.27
06-03	"	G4	2.47

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
06-04	Vibraphone, hard mallet	G#4	1.80
06-05	"	A4	1.50
06-06	"	A#4	2.20
06-07	"	B4	2.07
06-08	"	C5	3.97
06-09	"	C#5	1.73
06-10	"	D5	2.83
06-11	"	D#5	2.53
06-12	"	E5	2.20
06-13	"	F5	3.77
06-14	"	F#5	2.03
06-15	"	G5	2.23
06-16	"	G#5	2.10
06-17	"	A5	2.47
06-18	"	A#5	2.43
06-19	"	B5	2.43
06-20	"	C6	2.93
06-21	"	C#6	2.73
06-22	"	D6	1.90
06-23	"	D#6	2.80
06-24	"	E6	2.50
06-25	"	F6	2.37
06-26	"	F#6	2.23
06-27	"	G6	2.43
06-28	"	G#6	2.33
06-29	"	A6	2.10
06-30	"	A#6	2.63
06-31	"	B6	2.93
06-32	"	C7	2.77
06-33	"	C#7	2.97
06-34	"	D7	3.60
06-35	"	D#7	2.67
06-36	"	E7	2.57
06-37	"	F7	1.83
07-01	Vibraphone, bowed	F4	3.63
07-02	"	F#4	3.53
07-03	"	G4	2.93
07-04	"	G#4	2.60
07-05	"	A4	2.77
07-06	"	A#4	2.93
07-07	"	B4	2.10

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
07-08	Vibraphone, bowed	C5	2.93
07-09	"	C#5	2.63
07-10	"	D5	3.33
07-11	"	D#5	2.73
07-12	"	E5	2.70
07-13	"	F5	2.70
07-14	"	F#5	2.23
07-15	"	G5	2.63
07-16	"	G#5	2.53
07-17	"	A5	2.83
07-18	"	A#5	3.17
07-19	"	B5	2.83
07-20	"	C6	2.60
07-21	"	C#6	3.07
07-22	"	D6	3.73
07-23	"	D#6	2.73
07-24	"	E6	3.73
07-25	"	F6	2.57
07-26	"	F#6	2.07
07-27	"	G6	2.67
07-28	"	G#6	2.10
07-29	"	A6	2.60
07-30	"	A#6	2.70
07-31	"	B6	2.80
07-32	"	C7	3.80
07-33	"	C#7	2.43
07-34	"	D7	3.30
07-35	"	D#7	3.40
07-36	"	E7	3.20
07-37	"	F7	3.17
08-01	Glockenspiel, brass beater	G5	1.63
08-02	"	G#5	1.93
08-03	"	A5	1.63
08-04	"	A#5	2.93
08-05	"	B5	1.80
08-06	"	C6	1.00
08-07	"	C#6	1.93
08-08	"	D6	1.53
08-09	"	D#6	1.57
08-10	"	E6	1.90
08-11	"	F6	1.63

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
08-12	Glockenspiel, brass beater	F#6	1.80
08-13	"	G6	1.53
08-14	"	G#6	2.13
08-15	"	A6	1.80
08-16	"	A#6	2.23
08-17	"	B6	2.03
08-18	"	C7	1.70
08-19	"	C#7	2.07
08-20	"	D7	0.93
08-21	"	D#7	3.14
08-22	"	E7	2.07
08-23	"	F7	2.17
08-24	"	F#7	2.13
08-25	"	G7	2.13
08-26	"	G#7	2.07
08-27	"	A7	3.97
08-28	"	A#7	2.37
08-29	"	B7	2.63
08-30	"	C8	1.53
09-01	Crotales, brass beater	C6	3.67
09-02	"	C#6	3.47
09-03	"	D6	3.73
09-04	"	D#6	3.83
09-05	"	E6	3.30
09-06	"	F6	3.80
09-07	"	F#6	3.37
09-08	"	G6	3.23
09-09	"	G#6	2.87
09-10	"	A6	2.87
09-11	"	A#6	3.30
09-12	"	B6	2.93
09-13	"	C7	2.20
10-01	Tubular bells	C4	4.20
10-02	"	C#4	3.60
10-03	"	D4	3.73
10-04	"	D#4	2.73
10-05	"	E4	3.10
10-06	"	F4	2.63
10-07	"	F#4	2.87
10-08	"	G4	2.27

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
10-09	Tubular bells	G#4	2.53
10-10	"	A4	2.70
10-11	"	A#4	3.10
10-12	"	B4	4.67
10-13	"	C5	3.27
10-14	"	C#5	3.23
10-15	"	D5	2.50
10-16	"	D#5	3.30
10-17	"	E5	2.90
10-18	"	F5	3.17
10-19	"	F#5	3.07
10-20	"	G5	2.53
11-01	Military drum (15" by 10"), hit		2.73
11-02	Military drum, hit, inverse reverb		1.03
11-03	Military drum, cross stick		3.03
11-04	Military drum, roll,		3.60
11-05	Military drum, brush		2.30
11-06	Military drum, brush roll		3.87
11-07	Snare drum (14" by 12"), hit		3.27
11-08	Snare drum, hit, inverse reverb		2.87
11-09	Snare drum, cross stick		2.97
11-10	Snare drum, roll		3.10
11-11	Snare drum, brush		2.30
11-12	Snare drum, brush roll		3.97
11-13	Marching snare (14" by 12"), hit		1.60
11-14	Marching snare, hit, inverse reverb		2.30
11-15	Marching snare, cross stick		1.87
11-16	Marching snare, roll		4.37
11-17	Marching snare, brush		1.87
11-18	Marching snare, brush roll		3.43
11-19	Rock snare drum (14" by 6.5")		0.60
11-20	10" tom-tom		1.97
11-21	10" tom-tom, rimshot		3.73
11-22	8" tom-tom		2.13
11-23	8" tom-tom, rimshot		2.27
11-24	Small timbales		2.47
11-25	Small timbales, rimshot		2.40
11-26	Large timbales		2.80
11-27	Large timbales, rimshot		3.47
11-28	Large bongo, roll		5.20
11-29	Large bongo, hit		2.13

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
11-30	Small bongo, hit		2.50
11-31	Small bongo, roll		3.10
11-32	Conga, open tone		1.57
11-33	Conga, closed tone		3.60
11-34	Conga, pop		4.00
11-35	Conga, slide		2.67
11-36	Tumba, open tone		2.20
11-37	Tumba, closed tone		2.33
11-38	Orchestral bass drum		2.13
11-39	Rock bass drum		1.20
11-40	Tympani #1 (C2)		5.30
11-41	Tympani #2 (E2)		2.03
12-01	20" Chinese cymbals, crash		3.73
12-02	15" Turkish cymbals, crash		4.77
12-03	15" Turkish cymbals crash with soft mallet		5.57
12-04	Orchestral cymbals, crash		4.53
12-05	Large gong		11.40
12-06	Small gong		6.67
12-07	Medium gong		6.67
12-08	Brake drum #1		2.37
12-09	Brake drum #2		3.53
12-10	Alpenglocken #1		2.63
12-11	Alpenglocken #2		2.33
12-12	Alpenglocken #3		2.43
12-13	Alpenglocken #4		2.93
12-14	Cencerros #1		3.57
12-15	Cencerros #2		3.93
12-16	Cencerros #3		2.17
12-17	Cencerros #4		2.40
12-18	Agogo bells #1		2.20
12-19	Agogo bells #2		2.93
12-20	Finger cymbals		2.87
12-21	Ice bells		2.57
12-22	Sleigh bells		2.93
12-23	Mark-tree, low-high, chamber ambience		6.80
12-24	Mark-tree, high-low, chamber ambience		4.47
12-25	Small triangle		4.73
12-26	Large triangle		5.33
12-27	Bamboo chimes		6.00
12-28	Bamboo chimes, hit		1.83
12-29	Temple blocks, #1		1.50

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
12-30	Temple blocks, #2		2.07
12-31	Temple blocks, #3		2.23
12-32	Wood block, #1		1.60
12-33	Wood block, #2		3.13
12-34	Claves		2.47
12-35	Castanets, hit		1.50
12-36	Castanets, roll		2.47
12-37	Maracas, skin hit		1.50
12-38	Maracas, skin roll		2.93
12-39	Maracas, brass hit		2.30
12-40	Maracas, brass roll		3.60
12-41	Cabasa, hit		1.10
12-42	Cabasa, roll		2.97
12-43	Ratchet		2.17
12-44	Tambourine, roll		3.37
12-45	Tambourine, pop		1.80
12-46	Tambourine, shake		3.80
12-47	Whip		2.10
12-48	Cuica #1 (lowest)		4.30
12-49	Cuica #2		4.83
12-50	Cuica #3		3.03
12-51	Cuica #4 (highest)		4.57
12-52	Cuica, slide		3.83
12-53	Waterphone #1		11.37
12-54	Waterphone #2		7.13
12-55	Log drum #1		2.87
12-56	Log drum #2		1.90
12-57	Log drum #3		2.90
12-58	Log drum #4		3.37
12-59	Log drum #5		2.93
12-60	Chinese ascending gong #1		3.23
12-61	Chinese ascending gong #2		2.63
13-01	Bass saxophone	G#1	3.47
13-02	"	A1	3.30
13-03	"	A#1	4.03
13-04	"	B1	4.07
13-05	"	C2	3.37
13-06	"	C#2	3.20
13-07	"	D2	4.03
13-08	"	D#2	3.80

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
14-01	Baritone saxophone	C2	3.47
14-02	"	C#2	3.97
14-03	"	D2	3.10
14-04	"	D#2	4.47
14-05	"	E2	4.73
14-06	"	F2	4.50
14-07	"	F#2	4.00
14-08	"	G2	3.10
14-09	"	G#2	5.10
14-10	"	A2	5.33
14-11	"	A#2	5.50
14-12	"	B2	5.57
14-13	"	C3	3.43
15-01	Tenor saxophone	C3	2.33
15-02	"	C#3	3.43
15-03	"	D3	3.80
15-04	"	D#3	2.50
15-05	"	E3	3.77
15-06	"	F3	3.07
15-07	"	F#3	3.80
15-08	"	G3	2.27
15-09	"	G#3	2.27
15-10	"	A3	4.27
15-11	"	A#3	3.00
15-12	"	B3	2.87
15-13	"	C4	3.90
15-14	"	C#4	3.27
16-01	Alto saxophone	C#4	4.13
16-02	"	D4	3.60
16-03	"	D#4	3.87
16-04	"	E4	4.30
16-05	"	F4	3.33
16-06	"	F#4	3.10
16-07	"	G4	4.00
16-08	"	G#4	2.70
16-09	"	A4	3.07
16-10	"	A#4	3.83
16-11	"	B4	3.43
16-12	"	C5	3.53
16-13	"	C#5	2.73

TRACK-INDEX	INSTRUMENT	PITCH	DURATION (SECS.)
16-14	Alto saxophone	D5	2.43
17-01	Soprano saxophone	C#5	4.23
17-02	"	D5	5.67
17-03	"	D#5	3.47
17-04	"	E5	3.30
17-05	"	F5	4.07
17-06	"	F#5	4.13
17-07	"	G5	3.77
17-08	"	G#5	3.80
17-09	"	A5	4.63
17-10	"	A#5	3.07
17-11	"	B5	4.60
17-12	"	C6	4.07
17-13	"	C#6	5.07
17-14	"	D6	3.53
17-15	"	D#6	4.13

DIRECTORY INDEX

INSTRUMENT	VOLUME	TRACK	INDEX NUMBER(S)
Bamboo chimes	3	12	27-28
Bassoons:			
bassoon	2	14	1-32
contrabassoon	2	15	1-32
Bells:			
agogo bells	3	12	18-19
alpenglocken	3	12	10-13
cencerros	3	12	14-17
ice bells	3	12	21
sleigh bells	3	12	22
Cabasa	3	12	41-42
Castanets	3	12	35-36
Cello:			
bowed	1	11	1-47
harmonics, artificial	1	14	13-25
harmonics, natural	1	14	1-12
martelé	1	15	1-45
muted	1	12	1-34
pizzicato	1	13	1-39
Clarinets:			
b flat clarinet	2	10	1-37
bass clarinet	2	12	1-25
contrabass clarinet	2	13	1-25
e flat clarinet	2	11	1-32
Claves	3	12	34
Crotales	3	9	1-13
Cuica	3	12	48-52

INSTRUMENT	VOLUME	TRACK	INDEX NUMBER(S)
Cymbals:			
Chinese cymbals (20")	3	12	1
finger cymbals	3	12	20
orchestral cymbals	3	12	4
Turkish cymbals (15")	3	12	2-3
Double bass:			
bowed	1	16	1-44
harmonics, natural	1	19	1-12
martelé	1	20	1-37
muted	1	17	1-45
pizzicato	1	18	1-42
Drums:			
bass drum (orchestral and rock)	3	11	38-39
bongo (small and large)	3	11	28-31
brake drum	3	12	8-9
conga	3	11	32-35
log drum	3	12	55-59
snare	3	11	7-12
snare, marching	3	11	13-18
snare, military	3	11	1-6
snare, rock	3	11	19
timbales (small and large)	3	11	24-27
tom-tom (8" and 10")	3	11	20-23
tumba	3	11	36-37
tympani	3	11	40-41
English horn	2	9	1-30
Flutes:			
alto flute	2	5	1-30
bass flute	2	6	1-26
bass fl, flutter-tonguing	2	7	1-16
c flute	2	1	1-37
c flute, flutter-tonguing	2	2	1-29
piccolo	2	3	1-30
picc., flutter-tonguing	2	4	1-24

INSTRUMENT	VOLUME	TRACK	INDEX NUMBER(S)
French horn:			
muted	2	20	1-37
unmuted	2	19	1-37
Glockenspiel	3	8	1-30
Gongs	3	12	5-7
Chinese ascending gong	3	12	60-61
Maracas	3	12	37-40
Marimba	3	4	1-56
Mark-tree	3	12	23-24
Oboe	2	8	1-32
Pianos:			
9' Hamburg Steinway, loud	3	2	1-88
9' Steinway, soft	3	1	1-88
9' Steinway, plucked	3	3	1-88
Ratchet	3	12	43
Saxophones:			
alto saxophone	3	16	1-14
baritone saxophone	3	14	1-13
bass saxophone	3	13	1-8
soprano saxophone	3	17	1-15
tenor saxophone	3	15	1-14
Tambourine	3	12	44-46
Temple blocks	3	12	29-31
Triangle (small and large)	3	12	25-26

INSTRUMENT	VOLUME	TRACK	INDEX NUMBER(S)
Trombones:			
alto trombone	2	21	1-13
bass trombone	2	24	1-25
pedal tones	2	26	1-6
tenor trombone	2	22	1-36
tenor trombone, muted	2	23	1-33
Trumpets:			
c trumpet	2	16	1-34
c trumpet, muted	2	17	1-31
Bach trumpet	2	18	1-32
Tuba	2	25	1-32
Tubular bells	3	10	1-20
Vibraphone:			
hard mallet	3	6	1-37
bowed	3	7	1-37
Viola:			
bowed	1	6	1-42
harmonics, artificial	1	9	13-25
harmonics, natural	1	9	1-12
martelé	1	10	1-38
muted	1	7	1-39
pizzicato	1	8	1-34
Violin:			
bowed	1	1	1-45
harmonics, artificial	1	4	13-25
harmonics, natural	1	4	1-12
martelé	1	5	1-37
muted	1	2	1-45
pizzicato	1	3	1-40
Violin ensemble:			
bowed	1	21	1-44
harmonics, natural	1	23	1-12
martelé	1	24	1-30
pizzicato	1	22	1-21

INSTRUMENT	VOLUME	TRACK	INDEX NUMBER(S)
Waterphone	3	12	53-54
Whip	3	12	47
Wood block	3	12	32-33
Xylophone	3	5	1-44